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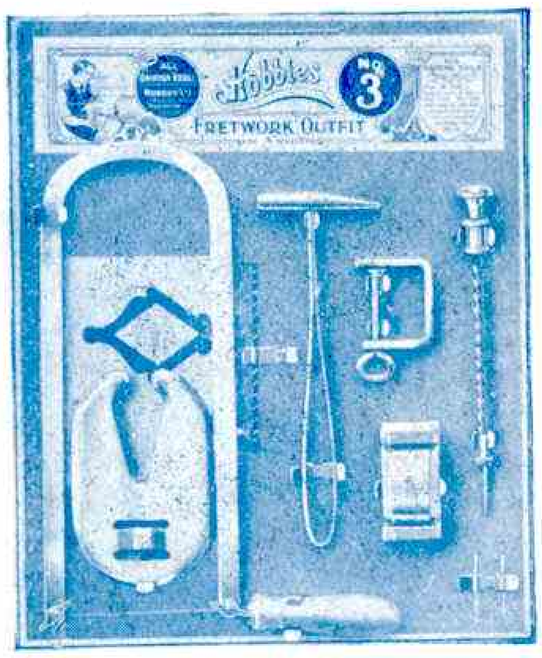
MECCANO MAGAZINE

Giant Riveter at Work at Niagara (See Page 2)

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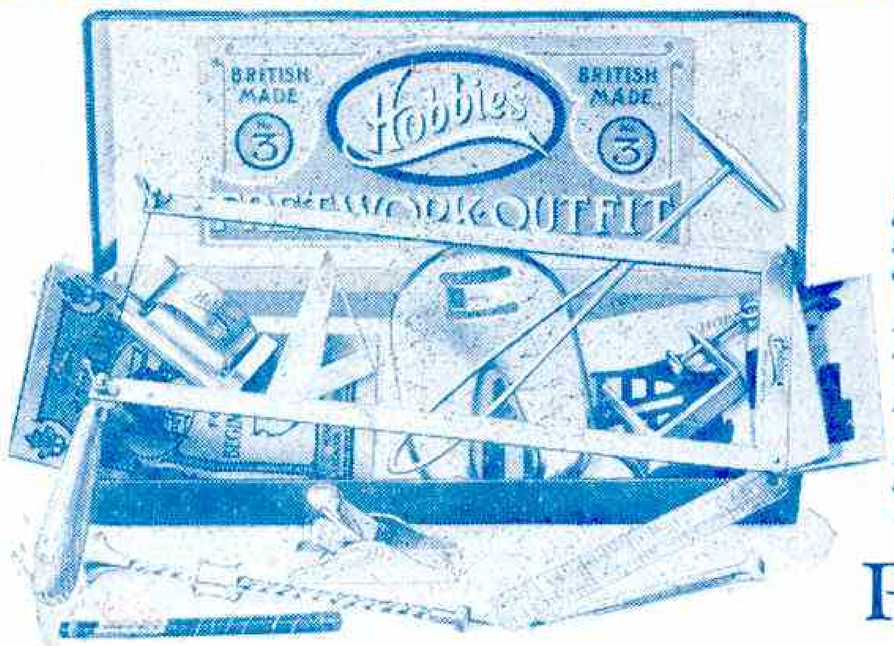


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OF BOYS

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January 1926

With the Editor

A Happy New Year to you All!

Every good wish for the New Year to all my readers! I hope it will be for each of you a year of joy and fun, and a year of progress in your studies or in your work, as the case may be.

I should like to take this opportunity of thanking my many readers for the wonderful array of Christmas and New Year cards that have reached me from all parts of the world, together with the hearty good wishes that accompany them. It is very pleasing to receive each year so many messages of good will from Meccano boys of almost every nationality.

I suppose there can be no other Editor who receives so many sincere wishes at Christmas time as the Editor of the "*M.M.*"—certainly no Editor receives so many interesting letters from his readers. Hundreds of them come to me every day from all towns in the United Kingdom. Every mail from our Dominions overseas and foreign countries brings hundreds more for the "*M.M.*" has readers in every civilised country in the world. Meccano boys in Siberia, Manchuria, Japan, Hong Kong, Borneo, Malay, the Himalayas, Afghanistan, Persia, India, Ceylon, the Pacific Islands, the West Indies, Tierra del Fuego, Mexico, Los Angelos, Vancouver, Ottawa, Newfoundland, Labrador and others "too numerous to mention" help to fill my mail bag all the year round.

It is very wonderful to me to think of these letters converging from all parts of the world to my desk at Liverpool. I can assure my correspondents that their universal expressions of interest in the "*M.M.*" are very encouraging and greatly appreciated

"Don't Forget to Write"

I welcome these letters not only because they show that my readers regard me as a friend but also because they demonstrate so keen an interest in the "*M.M.*" As I have previously mentioned in these columns, being an Editor is no easy task. It is impossible to please everybody and it is only when readers write to me that I am able to judge whether or not the majority are finding those articles they like best in our pages. On the whole, of course, it is fairly evident that this is so, because our circulation has increased from 20,000 copies to 80,000 during the past few years, and this in itself is sufficient evidence that the "*M.M.*" is giving readers what they want.

At the same time, I am always pleased to receive criticisms or suggestions for new articles, and when the majority are in favour of any alteration or addition I endeavour to carry out their wishes as far as practicable. For this reason, as I have said before, I welcome letters from my readers. I make a point of seeing that every letter is replied to personally—in fact, I have a special staff here to carry out this work—and although sometimes (particularly about this time of the year) a reply may be delayed for some days, every letter is answered in its turn—and, almost without exception, in the same language as that in which it is written!

Questions for the Editor

Those of you who have not yet written to me are invited to do so. If you have no criticism to pass on the Magazine, write and tell me about yourself, your school work or your hobbies. I am always interested to know how my readers spend their time, what work they are doing and what books they are reading. I should like to take this opportunity of mentioning also that as far as possible I am always willing to help my readers by giving them information even in matters that are not directly concerned with engineering or allied subjects. Questions were made to be answered and difficulties to be overcome, but I hope that my readers will first endeavour to "help themselves" before submitting their difficulties to me. A good encyclopædia can nearly always be consulted at a reference library, or some similar institution to be found in almost every town, and often such a book will be found to give all the required information. If this source has been tried unsuccessfully, write to me and I will gladly help you as far as possible.

Our 1926 Programme

Our increased circulation has enabled me to add permanently a number of extra literary pages to each issue. I am glad this is so because there are hundreds of interesting subjects about which I want to tell my readers.

In editing the "*M.M.*" it is necessary to plan several months ahead, and already numerous interesting articles are being prepared for publication during the next twelve months. These articles will not only be of general interest but, in accordance with our usual policy, they will also be of particular interest to Meccano boys. They will deal with all kinds of engineering achievements and some will describe wonderful machines or interesting mechanisms that may be reproduced in miniature.

Our series "Lives of Engineers" will be continued and in the coming year we shall deal with the Rennies, father and son; Sir Goldsworthy Gurney; Sir Charles Bright and others. Our "Electricity" articles and "The Story of Metals" are proving of great interest and actually are being used in some schools as a basis of study! In the former we hope to deal with Electric Lighting, X-rays and Wireless, and in the latter with Silver, Gold and the less-familiar metals used in steel manufacture.

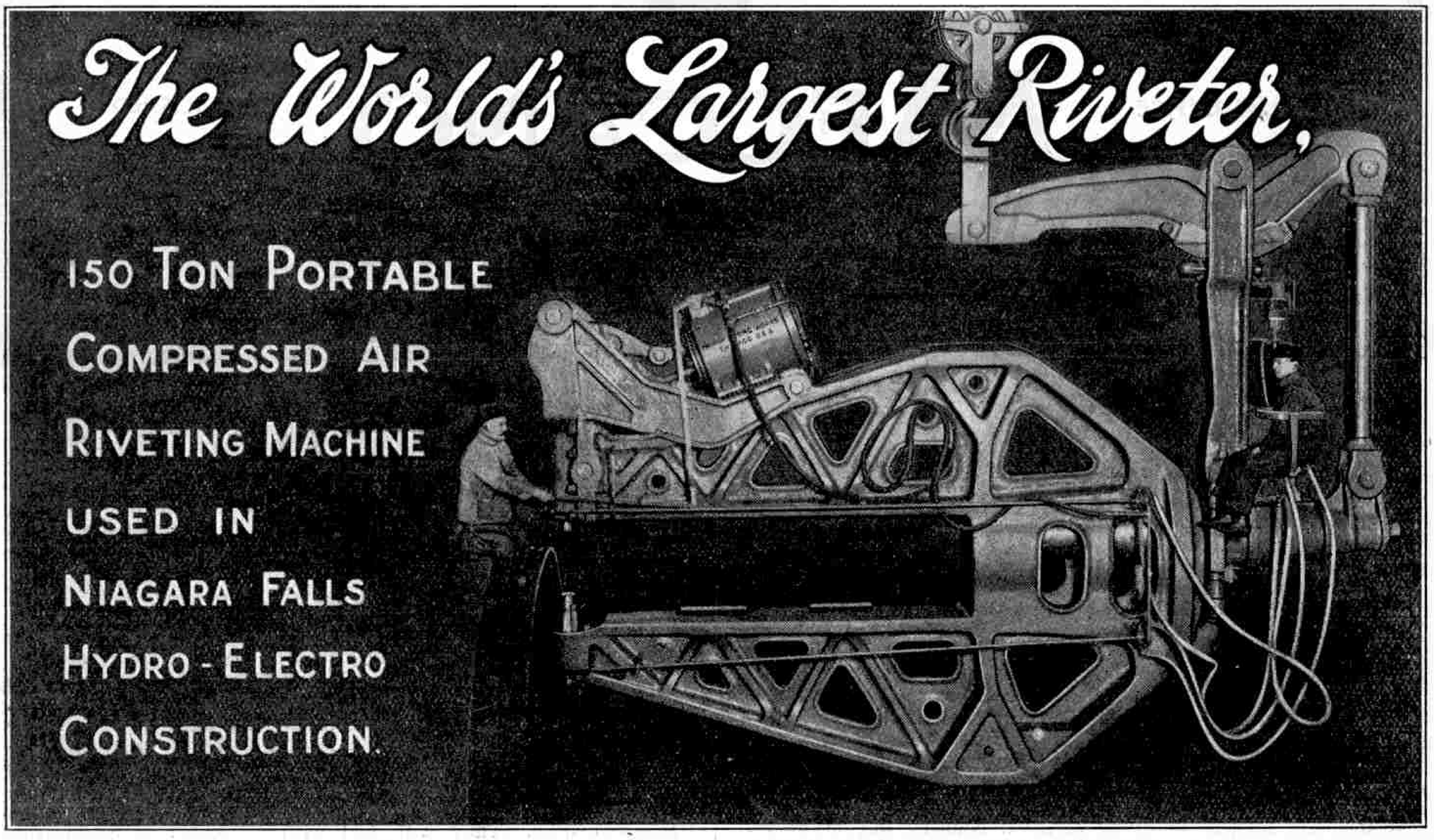
During the past year I have introduced three new features in the regular news dealing with Engineering News, Railway News, and Air News of the Month. I find that practically every one of my readers is interested in one or other of these subjects. In the past I have arranged, as far as possible, to have at least one article on each of these subjects in every issue, and I hope to continue this programme during the coming year.

Our Model-Building Competitions

Those readers who are particularly interested in Meccano model-building will find their requirements catered for during the coming year at even greater length than has been the case in the past. The splendid series of articles dealing with Standard Mechanisms, of service to all model-builders, will be continued. These articles will make model-building with Meccano easier than ever. What is, perhaps, of great importance is the fact that they ensure that no matter what model is being built, the construction will proceed on correct engineering principles.

Our model-building Competitions are attracting considerable attention and the response has been extraordinarily encouraging. I intend to continue these, at any rate until the summer, and hope to publish particulars and illustrations of as many as possible of the models entered. Thus non-competitors will be able to see the class of work that wins prizes and may be encouraged to enter future Competitions themselves. If the winning models in these Competitions are considered satisfactory, they will be included in future editions of the Manual.

The new idea of arranging separate Competitions for different Outfits has proved very satisfactory and even in the contests for owners of a No. 0 Outfit a surprising number of new and original models has been received. For instance, I do not suppose that many of my readers would have thought that a Loom that actually "weaves" could be made with a No. 0 Outfit! Such a model was entered in our recent Competition, however, and not only was a photograph of the model sent, but also a specimen of the fabric woven with it! Further particulars of the winning entries will be given elsewhere in these pages at the earliest opportunity.



RIVETING enters into almost every engineering process, from the construction of a Hornby Train to the building of a mighty bridge. Trains, trams, buses, motor-cars, steam-ships—all depend for their success on rivets, as do a vast number of smaller articles, too numerous to mention.

Even in our homes rivets are all-important, and it would be interesting to trace the part they play in each particular section. Take, for instance, the domestic gas-stove—not only is the stove itself held together by various kinds of rivets, but at the other end of the main are the huge steel containers. These gasometers are constructed of plates of rolled steel riveted together, and they maintain a never-failing supply of gas at the necessary pressure.

Riveting is one of the most important operations in engineering and upon it depends the success of almost every mechanical contrivance. Rivets are used extensively in bridge construction and in this connection we mentioned in our October number that about six-and-a-half-million rivets were used in the Forth Bridge.

Rivets also play a most important part in ship-building—in a vessel the size of the "Mauretania," for instance, four million rivets are necessary, the total weight of these rivets being over 700 tons.

We feel sure that our readers will be interested in the Giant Riveter described in this article and it only remains to add that we intend to describe the Niagara Hydro-Electric scheme in a future issue.

Riveting the Forth Bridge

The joints of a gasometer must be riveted with great accuracy to prevent leakage of gas, and a similar degree of accuracy is called for in riveting ships' plates.

Iron plates are riveted on to an interior framework that tapers away fore and aft to give the required girth amidships. In order to obtain the necessary accuracy, a pattern, or template, of thin board is made for every plate. This template is clipped in place on the framework of the ship as it lies on the stocks. On each template is marked the position of every rivet hole in the particular frame-member to which the metal plate will be attached. After the template has been marked it is removed and is clipped to the steel plate itself, on which the position of the frame-member and the rivet holes are then marked with white paint. The plate is then punched where marked for the rivets and planed at the edges to smooth off the rough metal. After being bent to shape, it is riveted in position on the framework of the ship.

As it is very necessary that all outside rivets should be water-tight, considerable care has to be taken to see that the shape of the rivets and of the rivet-holes accurately correspond. In this connection every rivet is carefully inspected before it is closed, and faulty rivets replaced before the joints are caulked.

Hydraulic and Pneumatic Riveters

The Forth Bridge, the story of which has recently been told in these pages, is one of the outstanding examples of riveting as applied to bridge construction. The bridge consists of 50,000 tons of steel and between six and seven million rivets were used. The plates for the main columns were 16 ft. in length, 3 ft. 9 in. in width, and half-an-inch in thickness and ten of these plates were riveted together by their longer sides to form a complete length of tubing, the vertical joints being strengthened by "T" girders, the heads of which were rivetted in with the joints. The columns were encircled by cages in which the squads of riveters worked. Corresponding cages were placed inside the columns and, as the work proceeded, both squads were simultaneously drawn up the column by block and tackle skilfully arranged and carefully operated.

In the early days of riveting, the work was done by hammering over the rivet with a hand-hammer, the red-hot rivet being held in position on the other side of the plate by a boy with a pair of tongs. Progress by this method was slow, however, and with the general speed-up of engineering mechanical riveters were introduced. These are chiefly of two kinds, hydraulic and pneumatic, and they can be constructed to give an enormous pressure on the head of the rivet, if required. The hydraulic riveter consists of a tool having two jaws movable about a central axle, and not unlike a huge pair of pliers. Water under pressure, conveyed to the riveter by a flexible pipe, causes the dies at the end of the jaws to close on both rivet and plate. Thus not only is the rivet formed but the jaws also press the plates tightly together at the correct instant. More than half the immense number of rivets employed in the construction of the Forth Bridge were placed in position by hydraulic riveting machines.

Heating Rivets on the Forth Bridge

One of the great difficulties in riveting is the question of heating the rivet, for it must be made and kept hot so that the metal will respond to the blow of the hammer or the grip of the riveting machine.

In the case of the Forth Bridge ordinary coal-fired furnaces were at first used for heating the rivets. These proved satisfactory for a time but as the work progressed it became clear that they could not be moved out with safety to outlying platforms. In addition to the tremendous

weight of the furnaces themselves there was also the weight of the fuel, and a further objection lay in the danger of timber-staging being set on fire by hot ashes from the furnaces. In the end, small oil-fired furnaces, constructed of iron lined with brick and weighing rather more than half-a-ton, were used with great success. They could be placed anywhere required by means of a crane and all that was necessary for their working was a small pipe to supply compressed air and a small tank of oil. Each of these furnaces could easily heat 200 rivets per hour.

For hand-riveting in the struts and lattice-girders of the bridge, small hand or treadle-operated forges were used. If an oil furnace was within reach it was used for pre-heating rivets for the hand workers. A great advantage of these oil furnaces was that when the furnace had finished a spell of work, and the air and oil were turned off, everything was cold in about five minutes, and there was no possibility of fire breaking out after the workmen had left.

Pneumatic Riveters

Another form of automatic riveter resembles the hydraulic riveter in construction, but is worked by compressed air. This type has been used for many years and the machines have grown in size to keep pace with the increased demands that have been placed upon them.

By the courtesy of the manufacturers, the Hanna Engineering Co., we are able to describe the largest portable riveting machine in the world. Compressed air is used not only to form the rivet heads but also to rotate the machine itself and to tilt it to the required angle. In this respect it is claimed that the machine is unique, for it is the first to be built that employs compressed air for manœuvring into position.

Before describing the Hanna riveter it may be well to give some idea of the nature of the work that it is required to perform. The machine was specially designed and built for riveting the huge plates forming the volute of the casings of three penstocks required in connection with a 70,000 h.p. hydro-electric turbine of the Niagara Falls Power Company. Each penstock is 18 ft. in diameter and about 110 ft. in length. The greatest distance across the volute is approximately 48 ft., and the diameter of the entrance where water enters is 15 ft. The plates to be dealt with varied in thickness from 1¼ in. at the entrance to ⅞in. at the end of the volute, and their construction required 7,800 rivets, each from 1 in. to 1½ in. in diameter.

Easily Controlled by One Man

Since the volute and penstock were required to hold water under a pulsating pressure of about 110 lbs. per square inch, the quality of this riveting work was required to be of a very high standard. Owing to the immense size and weight of the volute and penstock, the riveting had to be done on the actual site as the pipe was assembled section by section. This made a portable riveter a necessity and the large plates and correspondingly large rivets to be dealt with called for a riveter of high tonnage and long reach.

The total weight of the Hanna riveter is about 26 tons, and the weight of the frame—a one-piece steel casting—without spindle or riveting mechanism is 15 tons. Its maximum reach is 118 in. with a gap of 30 in. In spite of the great weight and size of this riveter it is easily controlled by one man, who can move this enormous machine from one position to another, roll it over or tilt it as desired. The operator can make it crush home the great hot rivets with but the slightest manual effort on his part.

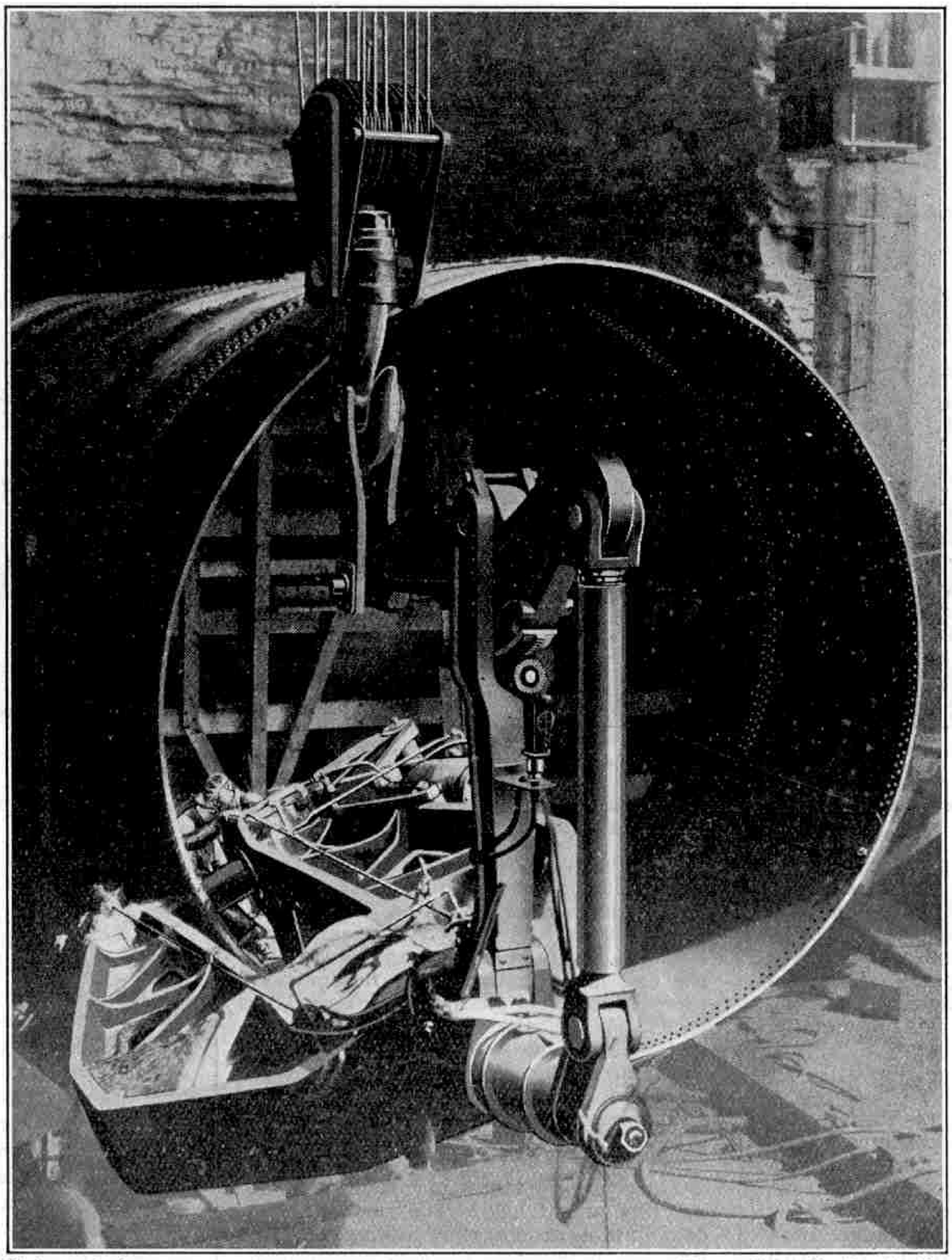


Photo courtesy] *Messrs. Hanna Engineering Co.*

The World's Largest Riveter at Work on the Giant Pipe

Revolving and Tilting the Giant Riveter

A stranger seeing the machine at work for the first time would be surprised at the power available and doubtless it would seem extraordinary that the sole source of this power is a slender hose-pipe that connects the machine with a standpipe some 40 ft. distant.

The supporting mechanism is so designed that when revolving the frame on the spindle, or tilting it upward or downward from the horizontal, the centre of gravity of all the parts hanging upon the crane hook is neither raised nor lowered. This is accomplished by the suspension beam (at top), the two vertical links, the spindle housing and spindle forming a parallelogram above the centre of gravity of the entire machine. With this arrangement the friction of the bearings and the inertia effects are the only forces to be overcome when it is desired to move the machine.

The two motions of revolving and tilting—which latter motion is limited to 30 degrees below the horizontal—are performed by two reversible, close-quarter, compressed-air motors of approximately 2 h.p. each.

The motor for tilting is mounted on the inner vertical (tension) link and drives a worm gear that engages with a sector on the suspension beam. The motor for rotating is mounted upon the spindle housing and drives a full worm gear upon the frame, so making it possible to set the frame at any desired angle around the spindle. Incorporated in this drive is a shock-absorber to eliminate the shock of stopping the massive frame, thus relieving the drive mountings of what otherwise would be great and practically unmanageable forces.

How the Riveter Works

Roller-bearings and ball-bearings are employed at all points of rotation, in order to overcome friction wherever possible and to reduce to a minimum the power necessary to move the frame into the required position. The frame is mounted upon its spindle by two radial roller-bearings and is restrained from longitudinal motion upon the spindle by roller thrust bearings. Four roller bearings—one at each end of the vertical links—

and two large ball bearings at the crane hook end of the suspension beam, come into action when tilting the frame.

Lubrication is by oil bath and positive pressure grease system. All moving parts are so arranged that they are completely protected from the elements.

Eliminating Skilled Operators

The Hanna Motion, or riveting mechanism, mounted upon this machine is a combination of toggles that merge into a lever action. It develops a known and pre-determined maximum uniform pressure during the leverage action at the last half of the piston stroke, in what amounts to the last 1 in. of die travel.

The size of the cylinder is 22 in. diameter, 22 in. stroke, and the movement of the plunger and upper die is $5\frac{3}{4}$ in., $4\frac{3}{4}$ in. of which distance being traversed during the 11 in. of the stroke. The last 1 in., die stroke, during the last 11 in. of the stroke of the compression-air piston, is under uniform pressure and movement. In other words, during the first half of the stroke of the piston the dies are coming up to the work and during the last half they form the rivet head. This arrangement assures of absolutely tight rivets being driven with each and every stroke of the piston. It also eliminates any adjustment of the die screw to overcome the ordinary variations in rivet lengths, thicknesses of plates, diameters of holes, etc., and because of this no particular "knack" or skill is required from the operator.

Seven Main Advantages

The chief advantages of this riveter motion are :—(1) As the machine exerts its maximum pressure throughout a considerable distance, careful adjustment of the die screw is unnecessary. (2) It is never necessary to employ more than one stroke to drive a rivet. (3) With each and every stroke the rivet is driven with a pre-determined known tonnage, produced irrespective of the judgment of the operator and leaving no uncertainty as to whether or not sufficient pressure had been given. (4) The maximum pressure with which the rivet is closed may be retained on the rivet head for any required length of time. The advance of the compressed air piston is arrested only by the complete formation of the rivet head. As long as the air pressure is retained in the cylinder the maximum closing pressure remains upon the rivet head and follows up any flowing of the metal of the rivet in the hole.

(5) The machine drives a rivet with every stroke and its action is so rapid that the number of rivets it will drive is limited only by the heating arrangements, the handling of the rivets, and the time it is desired to retain the full pressure on the rivet heads. (6) Although the movement of the compressed air piston is necessarily rapid, the maximum pressure is reached gradually and released in the same manner, so that there is no shock whatever when closing a rivet. (7) The wear of the working parts is quite unimportant because the movement in the journals or bearings is greatest and fastest during the first half of the travel of the compressed air piston. It is then that most of the motion is required to close the gap between the moving die and the end of the rivets, and consequently there is no stress on the various working joints. When the actual full load is sustained by the parts, the movement of the journals or bearings becomes very slow and comparatively slight in surface measurement.



Photo] [*Photochrom Co. Ltd.*

The Massive Tubular Girders of the Forth Bridge

The construction of the Forth Bridge was made possible only by the improvements in the art of riveting. Over 6,000,000 rivets were used in this great engineering work

Simplifying the Casting Problem

Three other features of general interest may be mentioned. The first is the demountable head or rivet-driving mechanism, which possesses obvious advantages.

The second is the movable buck-up or dead die, by which engaging sets of crown cams—one set upon the die and one set upon the frame—serve to raise the die when given a motion of rotation through 60 degrees. When in this raised position, the die is supported upon flat surfaces normal to its axis.

The third feature is the design of frame, in which—by employing the true truss form with open webs—the casting problem is simplified, owing to the absence of continuous surfaces with their resulting strains due to cooling. In addition to this, the stress conditions under service can be more definitely determined and hence the material may be more advantageously proportioned and located.

World's Record Broken

Complete manipulation of this machine is possible from a position at the head, three valve-operating handles being located here for riveting, rotating and tilting. A seat is provided near the rear of the machine, from which the rotating and tilting motor valves may be manipulated when operating conditions make this point of control preferable to the position at the head. In the latter case, the standard reversing valves built into the motors are utilised.

This riveter has not only broken the record for being the largest portable riveter yet built, but has also proved to be a great labour-saver, the economy at the completion of the second penstock having been computed to be at least 66 per cent.

The machine has developed remarkable speed in riveting and in this it has far exceeded the expectations of the designers, 45 rivets in 35 minutes being the record. The average performance is 450 rivets in a working day of 8 hours with one man in control as against the average of a riveting squad of seven men hand-riveting at the rate of 150 rivets per eight hour day!

Keeping a Diary

The popularity of diaries appears to grow year by year and in the very forefront among such pocket companions are those produced by Messrs. Charles Letts & Co. One of the most interesting of these publications is the "Schoolboy's Diary," which contains an extraordinary amount of interesting and practical information. This diary is certainly an admirable gift for any schoolboy. Another interesting diary is devoted to wireless and contains valuable descriptions of well-tried circuits, a list of experimental transmitting stations and other matters of interest to every wireless enthusiast. The "Boy Scouts' Diary" is planned on even more practical lines than was the case last year and indeed no Scout can really afford to be without his copy. Among Messrs. Letts's other publications are a "Motorist's Diary," and a "Cyclist's Diary," each containing matter of general interest and value.

Back Numbers of "*M.M.*"

Those who wish to complete their sets of "*M.M.'s*" will be interested to hear that we have in stock a few copies of recent issues.

All Magazines up to and including December, 1921, are out of print. A few copies remain of each number from January to December, 1922, with the exception of the issues of March—April. A very few copies of January, March, May, July and December 1923 only are available. A few dozen of each month in 1924 are in stock.

Copies of back issues will be sent post free, price 3d. each up to and including November 1924. December 1924, 5d. All 1925 copies 4d. each, except December, 1925, the price of which is 8d. post free.



Lives of Famous Engineers

XXIV

JOHN SMEATON

LIGHTHOUSE BUILDER

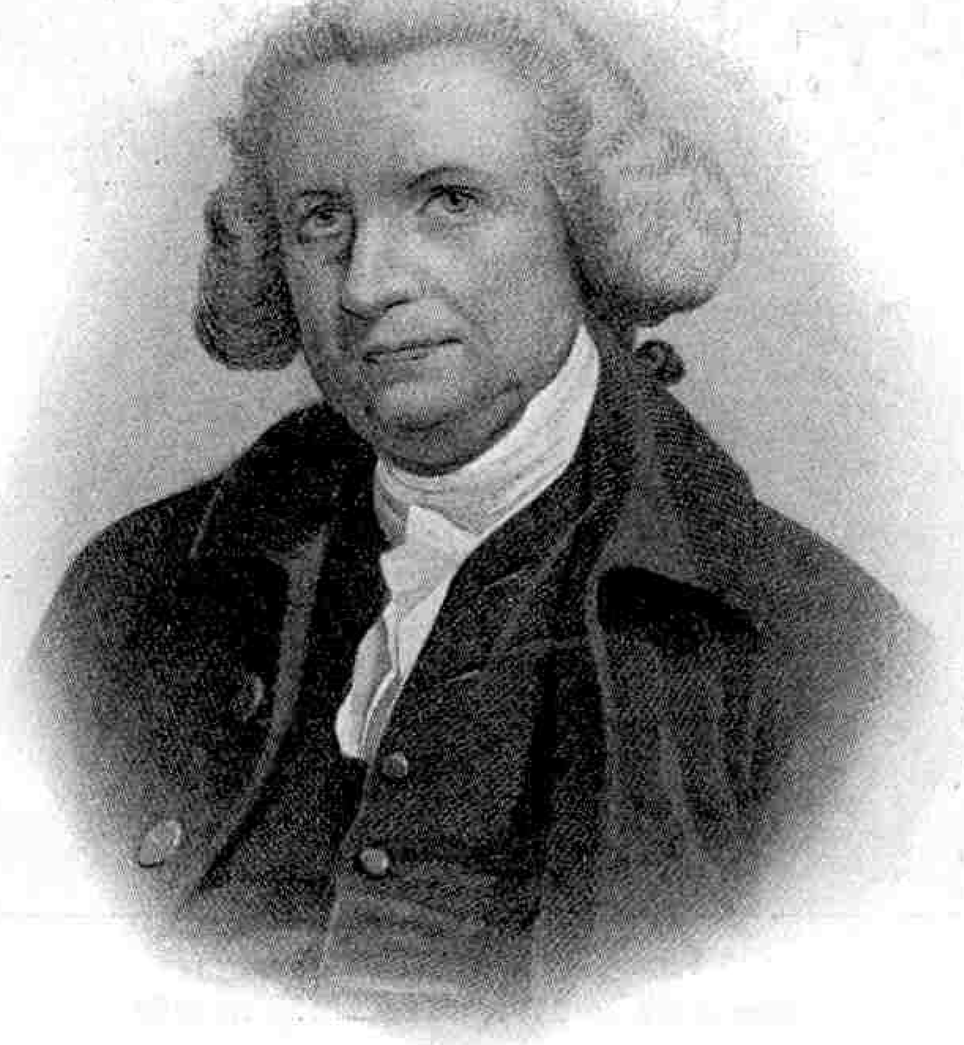
JOHN SMEATON was born on 8th June, 1724, at Austhorpe Lodge near Leeds, in which city his father practised as a solicitor. At that time Leeds was a place of comparatively small importance. The principal streets, which still exist under their old names, were Briggate, leading to the bridge, Kirkgate leading to the parish church, and Swinegate leading to the old castle. Beyond these streets lay open fields. Boar Lane, which is now in the centre of the present-day city of nearly half-a-million inhabitants, was a pleasant suburb in which lived the principal merchants. Austhorpe was then quite in the country, the only houses in the neighbourhood being those of the tiny hamlet of Whitkirk and the neighbouring mansion of Temple-newsam.

Boyhood days

From his earliest years Smeaton displayed unusual thoughtfulness and powers of observation, and the ability, not only to take his toys to pieces, but to put them together again successfully. The only toys in which he appeared to take any real pleasure were his models of things that would work, and he was perfectly happy so long as he had any kind of cutting tool with which he could make little models of pumps and windmills. He never lost an opportunity of watching the operations of carpenters, masons, or other workmen who happened to be employed in the neighbourhood. He observed closely how they handled their various tools and implements and frequently asked questions in which he showed so much intelligence that the workmen gave him serious and careful answers.

No sooner had the boy thoroughly grasped the methods by which workmen carried out a certain task than he began to attempt similar operations in miniature. Sometimes this habit upset the feelings of the family, as on the occasion when, after watching some millwrights at work, he was discovered on the top of his father's barn busily engaged in fixing a wooden mill-like structure!

These free-and-easy childhood days with their escapades came to an end and in due course Smeaton began his education at Leeds Grammar School, but although his progress there in geometry and arithmetic was very rapid the most valuable part of his education was carried on at home among his tools and his models.



John Smeaton

Pump that succeeded too well!

It was during this period that his mechanical ingenuity led him into trouble. It happened that a steam engine was being erected at Garforth for the purpose of pumping water from the coal mines, and as might be expected Smeaton was there day after day, keenly watching the operations. He quickly grasped the principle of the steam engine and the method of erecting it and promptly set to work at home to make a miniature engine of his own, equipped with pumps and other apparatus. Having made the engine the next step obviously was to test its powers and this he did upon one of the fish ponds in front of the house at Austhorpe. There was no doubt whatever about the efficiency of his engine for he succeeded in pumping the pond completely dry, with, of course, disastrous results to the unfortunate fishes!

Skill in Metal Working

By the time Smeaton was 14 he had made himself a lathe on which he turned wood and ivory. Subsequently he learned to work in metals and at the age of 18 he could handle tools quite as well as any regular carpenter or smith.

In his sixteenth year Smeaton left school and commenced work in his father's office, copying documents and commencing the preliminary training for the legal profession. His father had an excellent practice and wished his son to succeed him, but this was not to be. The boy's heart was in his workshop among his tools and models, and although he attended the office punctually and worked steadily, it was plain to his father that he felt no interest or enthusiasm in Law.

Law Abandoned

In 1742 the boy was sent to London with the object of breaking him away from his mechanical pursuits and at the same time giving him the best possible legal education. For a time he attended the Courts regularly, but at length he realised that it was useless to go on and he wrote to his father explaining his feelings and asking to be allowed to follow some mechanical occupation. This letter was a great disappointment to the father, but he was broadminded enough to understand that his son could never achieve success in a profession he hated, and he replied giving his assent to the change.

In order to understand to some extent the feelings of the father regarding his son's proposal it is necessary to remember that at that time there was no such profession as Civil Engineering. Almost all the mechanical work of importance was then executed by millwrights and others at little more than labourers' wages. In the eyes of most people, therefore, Smeaton was doing a wildly foolish thing in giving up the prospects of a highly respectable and lucrative profession and descending to the lower social status and poor pay of a workman.

Training as Instrument Maker

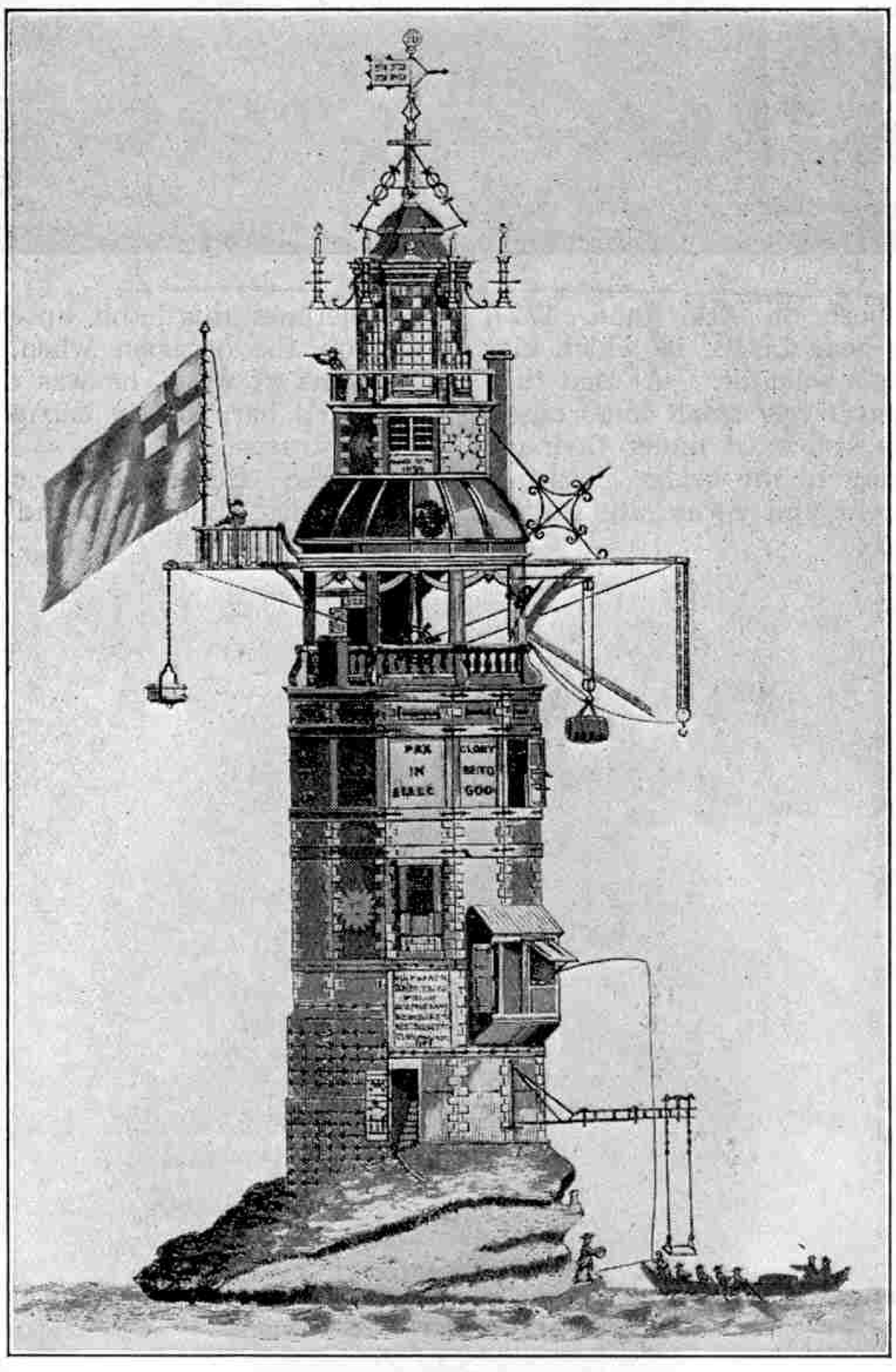
As may be imagined, Smeaton's delight was unbounded when he received his father's consent, and he lost no time in taking advantage of his liberty. He entered the service of a scientific instrument maker in order to obtain expert instruction, his father in the meantime providing for his maintenance. It was not long before Smeaton was able to maintain himself, but his father continued to assist him liberally when occasion demanded.

During this period Smeaton was a regular attendant at the meetings of the Royal Society. In 1750, shortly after he had commenced business on his own account as a mathematical instrument maker, he read a paper before the Society regarding improvements in the mariner's compass. In the following year he carried out experiments on the Thames and at sea to test a machine of his own invention for the purpose of measuring the way of a ship. Subsequently he read before the Society papers on improvements to the air pump and dealing with the steam engine and various other mechanical matters.

Visits Holland and Belgium

Gradually Smeaton began to devote less time to instrument making and to turn to the wider field of engineering. He read diligently all the English books he could find, and not content with this he learned French in order to be able to read the numerous engineering works written in that language. In learning French he had in mind also the possibility of a visit to the Low Countries for the purpose of examining the great canal works that existed there. In 1754 he was able to carry out this project. He traversed Holland and Belgium, examining the canal works and harbour and dock developments, and making detailed notes which afterwards proved of enormous value to him in his work as a canal and harbour engineer.

Soon after his return to England in 1755 an event occurred that provided an opportunity for his constructive genius and led to the greatest success of his engineering career—the building of the Eddystone lighthouse.



First Eddystone Lighthouse.
Completed in 1700, swept away in 1703

The Eddystone Rock

The Eddystone rock forms the crest of a reef of rocks situated in deep water in the English Channel about 14 miles from the Plymouth breakwater and 9 miles from the nearest coast of Cornwall. Some of the rocks are visible at low water but at high water they are almost entirely submerged. As the rocks lie nearly in the track of vessels going up or down the Channel they were the cause of many terrible wrecks before their position was indicated by the erection of a lighthouse. Not only were vessels wrecked upon the rocks themselves, but many a ship's captain, taking a course to the southward in order to give this peril a wide berth, found himself involved in equally serious dangers along the French coast or among the rocks that surround the Channel Islands.

The first attempt to construct a lighthouse upon the small crest of rock visible at high water was made by Henry Winstanley of Littlebury, Essex. Winstanley appears to have been a very curious individual. There is no doubt that he possessed great mechanical ingenuity but there was something fantastic or grotesque about his various productions.

Winstanley's Lighthouse

Smeaton tells us in his "Narrative of the building and a description of the construction of the Eddystone Lighthouse with Stone" that Winstanley's house was a somewhat exciting place for guests. In one room, for instance, there lay on the floor an old slipper. The natural instinct of everybody was, of course, to kick this slipper, and immediately this was done an alarming-looking ghost arose from the floor. In another room was a chair that looked particularly inviting, but immediately anyone sat down in it two arms shot out and held him prisoner. Worst of all was the contrivance in the summer house in the garden, for when anyone sat down on a particular seat he was immediately deposited in the middle of the adjacent canal. It is not surprising that a man who would spend time and money on schemes of this kind should produce a fantastic structure when he turned his attention to lighthouse-building.

Difficulty of Building Operations

Work on Winstanley's lighthouse was commenced in 1696 and it lasted four years. The first summer was spent entirely in boring twelve holes in the rock and fastening in them twelve irons to hold the super-structure. This was a work of considerable difficulty and danger, and operations could be carried on only during fine weather when the sea was comparatively smooth.

In his narrative of the work Winstanley says :—" Though nothing could be attempted to be done but in the summer season, yet the weather then at times would prove so bad that for 10 or 14 days together the sea would be so raging about these rocks, caused by outwinds and the running of the ground seas coming from the main ocean, that although the weather should seem and be most calm in other places, yet here it would mount and fly more than 200 ft. as has been so found since there was lodgement on the place ; and therefore all our works were constantly buried at those times and exposed to the mercy of the seas ; and no power was able to come near to make good or hold anything as I have often experienced with my workmen in a boa$_t$ in great danger."

Structure Rises to 80 ft.

The second year was spent in making a solid pillar 12 ft. in height and 14 ft. in diameter upon which to set the lighthouse. In the third year all the upper work was erected to the vane, which was 80 ft. above the foundation.

During the summer of that year Winstanley took up his abode with the workmen in the lighthouse. On the same night a great storm arose and eleven days elapsed before any boats could come for them. During this time all in the lighthouse were half-drowned and their provisions were soaked. The light was exhibited for the first time on 14th November 1698 and subsequently the building was strengthened in various ways. Our illustration gives a good idea of the curious appearance of this remarkable structure, Winstanley being shown fishing from the kitchen window !

Swift Disaster

In spite of its weird structure this lighthouse survived until 1703 and then came disaster. In November of that year Winstanley went off to the lighthouse to superintend certain repairs and while he was still there a storm of unparalleled fury occurred on the night of the 26th. At dawn on the following morning many anxious eyes from the shore looked out across the raging seas in the direction of the rock to see if the lighthouse had withstood the gale, but not a vestige of it remained !

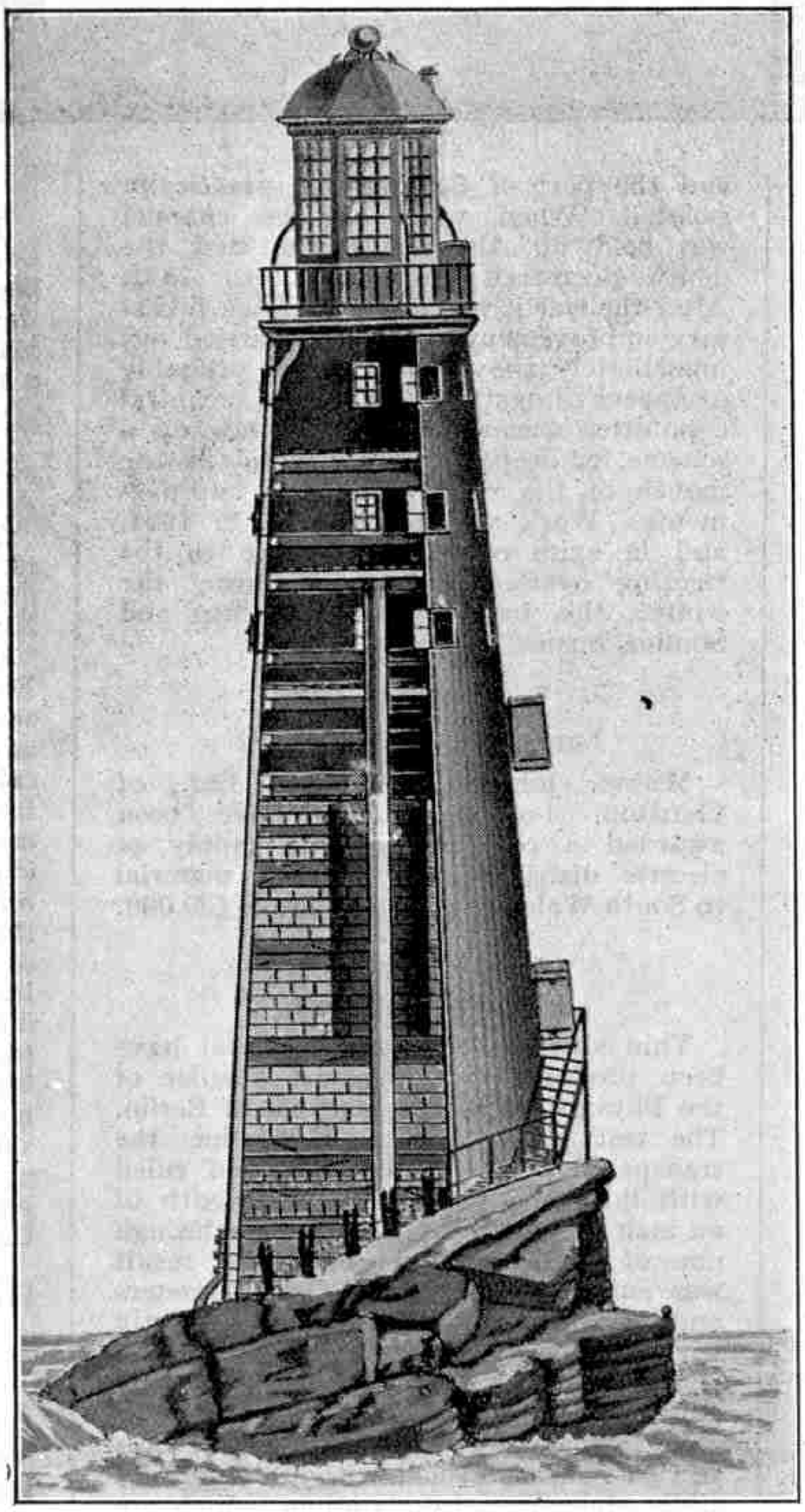
Winstanley's lighthouse was a hopeless piece of work from the point of view of stability, but due credit must be given to its builder in having undertaken a piece of work that previously had been considered impossible.

The sweeping away of this lighthouse left the Eddystone problem as serious as before, and it was not long before a new lighthouse builder appeared upon the scene.

Rudyerd's Structure

This time the architect was John Rudyerd, who kept a silk shop in London. Rudyerd was the son of a Cornish labourer of bad character and as he declined to join the family schemes for pilfering he found life at home so unpleasant that he ran away. He was befriended by a gentleman at Plymouth, whose servant he became, and who gave him the opportunity of learning the rudiments of reading, writing and arithmetic.

It is not clear how Rudyerd worked his way up to be a successful shop-keeper or how he became qualified for the execution of a formidable engineering task. All we know is that in 1706 the Corporation of Trinity House obtained an Act of Parliament enabling them to rebuild the lighthouse, vesting in them all duties payable by shipping passing the lighthouse, and giving them power to grant a lease to an approved person who should undertake the construction of the building. They agreed with a Captain Lovet for a term of 99 years commencing from the day that a light should be exhibited, and it was Captain Lovet who employed Rudyerd. Apparently there is no record of how Lovet came to discover Rudyerd's engineering knowledge and ability.



Rudyerd's Lighthouse.
Completed in 1709, destroyed by fire in 1755

Contrast in Design

Winstanley and Rudyerd presented the strongest possible contrast in their mechanical ideas. Whereas the former, as we have seen, was unable to avoid what might be called freak designs, the latter had no thought for anything beyond the essentials of solid strength and suitability for the purpose. To use Smeaton's words : " He saw the errors in the former building and avoided them. Instead of a polygon he chose a circle for the outline of his building and carried up the elevation in that form. . . . He seems to have adopted ideas the very reverse of his predecessor, for all the unwieldy ornaments at the top, the open gallery, the projecting cranes and other contrivances more for ornament and pleasure than use, Mr. Rudyerd laid totally aside."

The means employed by Rudyerd to fix the work to its foundation proved thoroughly efficient. Holes were cut in the solid rock in which strong bolts were keyed, any spaces being afterwards filled with molten pewter. To these bolts were fixed squared oak baulks and across these shorter baulks, and so on until a solid basement of wood was raised, firmly bound together with screw bolts. In order to further strengthen his basement and counteract the tendency of the waves to move it he interposed courses or layers of Cornish stone thoroughly joined and cramped with iron. Outside the solid timber and stone courses strong upright timbers were fixed and carried upward as work proceeded. The light was exhibited in the lantern on 28th July 1706 and the structure was completely finished in 1709.

Destruction by Fire

This lighthouse was in most respects well adapted for its purpose as is proved by the fact that it withstood all storms for nearly 50 years. Its fatal defect was that, like Winstanley's structure, it was built of wood. About two o'clock in the morning of 2nd September, 1755, the light keeper on duty, on going up into the lantern, found it full of smoke.

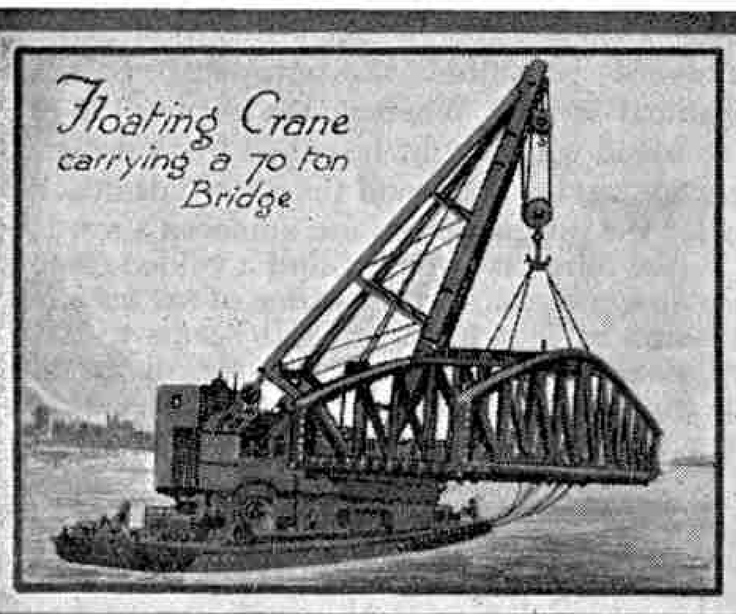
In a few minutes the wooden structure was ablaze. The men could not bring water up the tower in sufficient quantities to have any effect, molten lead began to shower down and they were driven from room to room, the fire following them. Ultimately the men took shelter from the molten lead and falling timbers under a ledge of the rock on its eastern side, and after the fire had been burning some eight hours they were rescued, more dead than alive, by fishing boats.

Smeaton appointed Architect

The lease of the lighthouse had by this time passed into the possession of Robert Weston and two others, and after the destruction of Rudyerd's building Weston applied to the Earl of Macclesfield, President of the Royal Society, for advice as to the choice of an architect to undertake the new building. Lord Macclesfield recommended Smeaton, and Weston immediately approached him on the subject.

At first Smeaton was under the impression that the lighthouse had not been totally destroyed and that all that was required of him was the repair of its upper works, and he declined the proposal. When it was made clear to him that an entirely new structure must be erected, he took the matter in hand and brought the full weight of his ability to bear upon the problem of designing a building that should be storm-proof and fire-proof. The subject was quite new to him but he lost no time in investigating it thoroughly, and one of the earliest conclusions at which he arrived was that the new building must be constructed of stone.

Next month we shall describe how Smeaton planned and erected a wonderful lighthouse that stood without flinching for over 100 years.



Engineering News of the Month

Continental Shipbuilding Losses

Speaking at the recent launch of the great new battleship H.M.S. "*Nelson*," from the yard of Messrs. Armstrong Whitworth & Co., at Newcastle, Sir Eustace D'Eyncourt drew attention to the present very bad state of British shipbuilding, caused, to a great extent, by keen competition from Continental yards. He pointed out that in that particular shipyard there were berths for 12 vessels, with the necessary plant, equipment and staff, but only one berth was occupied though they had one or two small ships in hand. Unless something was done very quickly it was impossible to say what would happen to the shipbuilding industry. This bad shipbuilding outlook is further illustrated by Lloyds returns for the last quarter, which show that there were fewer ships under construction in Great Britain than there had been for the past 16 years.

In view of this shipbuilding depression it is interesting to note that Messrs. Krupps big yard at Kiel has lost 19,000,000 marks (about £950,000), most of which is attributed to the building of ships for the Standard Oil Company. The losses show that the low prices quoted by the Continental firms in competition with British firms have been so cut down as to involve heavy financial losses.

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South African Road Construction

The construction of roads in asphaltic concrete, a method employed to a considerable extent in the Western States of U.S.A., is now being undertaken in Johannesburg, where, during 1924, two thoroughfares were constructed in this way.

The Borough of Durban has also adopted asphalt as the standard paving material, but before the method of construction was definitely decided upon, the council carefully studied road making methods in this country and America. Over 250,000 sq. yards of causeway have recently been reconstructed in the borough and other large areas are now being dealt with.

The preparation of asphaltic concrete is very similar to that of Portland cement concrete, except that instead of Portland cement bitumen is employed.

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Danube Navigation

In recent years considerable efforts have been made, notably in the construction of ports, docks, and warehouses, to improve the navigation facilities of the Danube, and Roumania is keenly interested in the work recently completed by the European Danube Commission. During the war the old channel became silted up and the port of Soulina was practically isolated. When work on the channel was held up, the result was that the depth decreased from 24 ft. to 13 ft. After the war it was felt that if the necessary improvements were not carried out immediately the channel would probably disappear altogether. In 1921 a technical committee was appointed, to draw up a scheme for deepening the channel at the mouth of the river and other improvements. Work was commenced in 1922, and in spite of difficulties due to the freezing over of the river during the winter, this has now been finished and Soulina opened to cargo boats.

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Large Electrical Contract

Messrs. Johnson & Phillips Ltd., of Charlton, London, S.E.7, have been awarded a contract for the supply of electric distribution lines and material to South Wales, to a total value of £30,000.

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Transparent Steel

Thin sheets of transparent steel have been produced by Dr. Karl Mueller of the Physical Technical Institute of Berlin. The test plates used to determine the transparency of optical glass, and ruled with lines one twenty-five hundredth of an inch apart, were photographed through one of these metal sheets. The result was enlarged to four hundred diameters and the scale lines showed distinctly without any distortion, proving that the structure of the film of steel is even and equal in all directions.

So thin are the metal sheets that atoms will pass through them without hindrance while alpha rays from radium, which are completely stopped by a sheet of paper, are not perceptibly weakened in passing through a sheet of the metal. When fastened in a frame, a sheet of the metal may be bent out, by blowing on it, to a sixteenth of an inch without rupture, showing that although it is very thin it is none the less strong.

These thin sheets of steel will probably prove of great service in metallurgical research and in the making of galvanometers and wireless receiving sets.

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Reclaiming Land in West Indies

The scheme for the reclamation of a large area of marsh-land in Bermuda, has so far developed that orders are being placed in England for some of the plant and equipment required for the undertaking.

Nigerian Wharf Extensions

The Horseley Bridge and Engineering Co. Ltd., of Tipton, Staffordshire, have been engaged for the past six months on the work of extending the wharf at Port Harcourt, Nigeria. The contract involves a sum exceeding £100,000.

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World's Largest Bucket Dredger for Southampton

The largest and most powerful craft of its type afloat, a new non-propelling bucket dredger, has recently been completed for the port of Southampton by Messrs. Verschure and Co.'s Shipbuilding and Engineering Co., Amsterdam. The new vessel is 200 ft. in length, 35 ft. in breadth, and 13 ft. in depth, and is capable of raising 1,600 tons of material per hour from a depth of 75 ft. The dredging machinery is driven by a vertical triple-expansion steam engine of 600 h.p. The number of buckets required to work at the maximum depth is 61, and the weight of the bucket-ladder, which is suspended by two steel cables of 90 m.m. diameter, including weight of buckets, etc., is 150 tons. Steam is supplied by a Scottish boiler of 15 ft. diameter. The hull and machinery have been built under special survey of Lloyd's and the British Board of Trade, the work having been completed within nine months of booking the contract.

The ship carries a crew of 23, accommodation for whom is provided below deck.

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Dock Improvements at Durban

In view of the steady growth of the coal trade at Durban docks, the facilities for the storage and handling of coal at that port are to be considerably improved. The storage accommodation is to be increased and additional mechanical appliances provided for the quick handling of the coal. At present 10,000 tons can be stored but when the present work is completed there will be ground storage for 60,000 tons.

Sir Wm. Arrol & Co., of Glasgow, have been awarded the contract for the new mechanical plant, estimated to cost £75,000. The plant will consist of two travelling hoppers, each having a capacity of 120 tons, and a travelling transporter with two travelling carriages and two grabs for off-loading coal at a minimum rate of 150 tons each per hour. The transporter is also intended for loading the storage bins with the existing 6-ton drop bottom buckets, at a minimum rate of 200 tons per hour for each travelling carriage.

Huge Power Houses for Australia

The authorities in Sydney are planning to erect a new power-house at Burnerong Point, a site near the historic landing place of Captain Cook at Botany Bay. The plant will be erected in three units, each of which will have a capacity of 100,000 kilowatts. The cost of erecting and equipping these units will be £2,000,000 each. It is expected that the first unit will be in operation by the end of 1928.

The Commissioners controlling the Government power-houses are also contemplating extensions. The success of one or two hydro-electric schemes in the country districts is causing favourable consideration to be given to the possibilities of using the State's power resources to greater advantage.

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Centenarian Engines

Addressing the Manchester Association of Engineering the new President, Mr. R. Onions, referred to the boldness and success that attended the work of the early engineers. A splendid example, he said, was a pair of large beam pumping engines, made by Messrs. Boulton and Watt over one hundred years ago, which are to-day in excellent condition and are working at Deeping Fen, Lincs.

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Meccano Houses

Still another type of house is now being demonstrated in London. This is the Dennis-Wild model, of which numbers have already been erected in Bradford, York, Blackpool, and other northern towns.

This home, which has been thoroughly approved by masters and men in the building trade, employs the ordinary building materials, but in a comparatively small percentage. Its outstanding merit is that it is constructed upon a steel frame, which enables the roof to be put on at once and all the other work carried out under cover, thus eliminating the ordinary building delays involved in what is called "wet time." Such a house, with all the bricklaying, plastering, and carpentry required, can be completed in anything from eight to ten days.

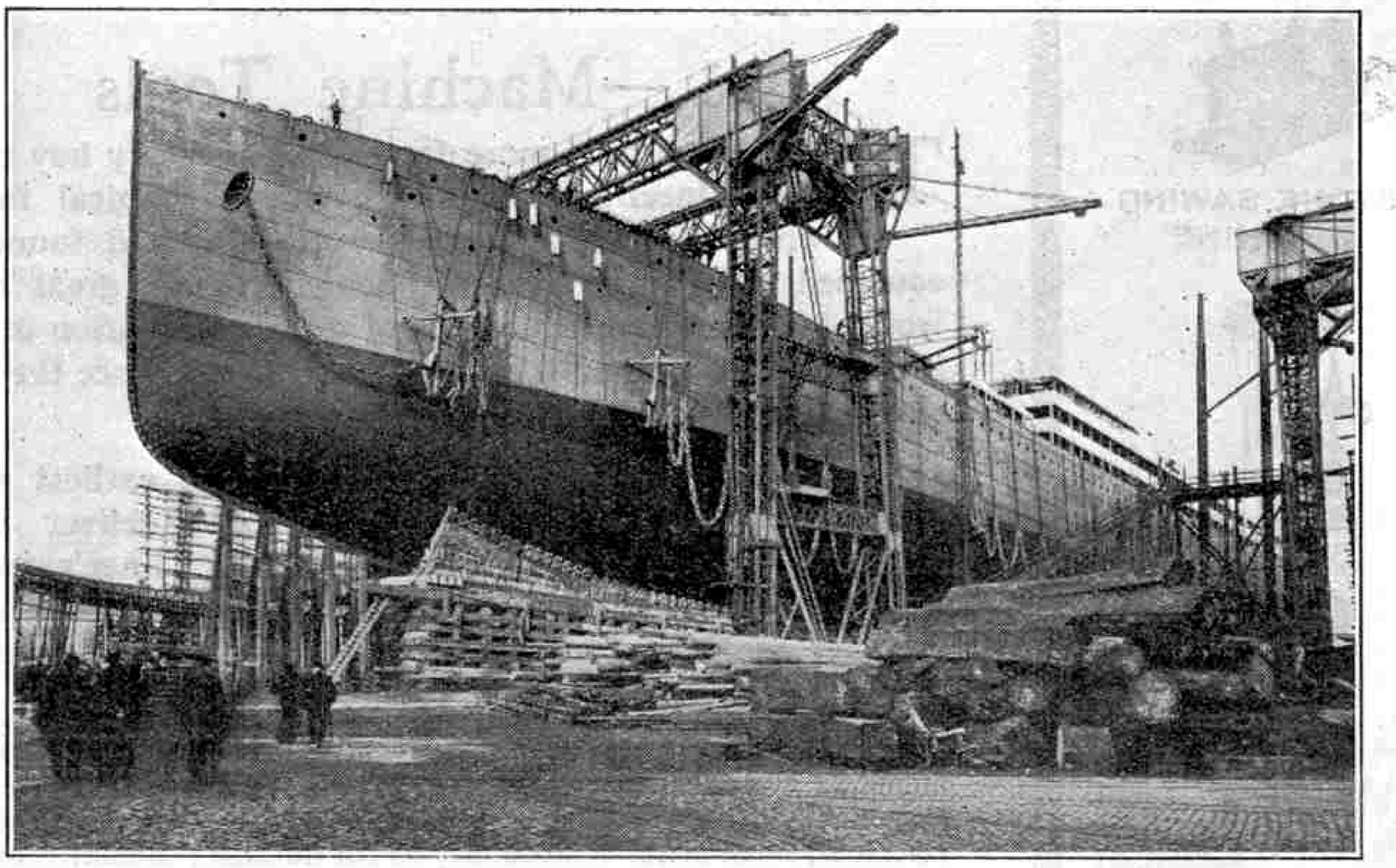
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Tram Standard Explodes

A man who struck a match against a tramway standard at Burton-on-Trent, was astonished to hear an explosion, and the next moment the ornamental metal top of the standard fell and missed the man by inches. It was then found that an electric wire inside the standard had fused and melted a gas pipe, causing gas to accumulate in the standard. At the time of the explosion a youth in a house near struck a match near a gas oven. An explosion followed, and the windows of the house were wrecked. The youth escaped with a shock.

Ford Buys American Ships

Mr. Henry Ford has announced that he will buy the 300 vessels belonging to the United States Shipping Board, if the Government will fix a fair price. He will scrap the majority of the ships and re-condition between 10 and 30 for use in the Ford industries. This purchase will be the largest transaction in maritime history, for 2,541 ships are concerned.



Our illustration shows a bow-on view of the "Adriatic" on the stocks, one of the giant liners of the White Star Line. This great vessel of 24,541 tons is now plying between Liverpool and New York (via Queenstown). The illustration is more than usually interesting at the present time because of the depression in the ship-building yards at home, which depression now appears to be spreading to foreign yards.

Heroes of Runcorn Bridge

The heroism of two Runcorn workmen, William Allman and Fred Dutton, in rescuing a workmate from a hollow iron girder on the Runcorn Bridge has not been allowed to go unnoticed by their employers, the L.M.S. Railway Company.

Allman and another workman were carrying out preparations for inspection in the small iron tubular girder 18 in. in height and 15 in. in width, when the man inside the girder failed to give the customary signal of his position. Allman, who was working outside, gave the alarm, and he and Dutton entered the girder from opposite ends and extricated the man after a two hours' struggle. Inch by inch they worked inside the girder until they brought their unconscious workmate to the open. He was taken to the Runcorn Cottage Hospital where he remained over a hundred hours unconscious before he succumbed.

A tribute to the gallantry of these two brave men was paid by Mr. Turnbull, the engineer of the L.M.S. at Crewe, where a presentation was made. The company have not only showed tangible recognition, but have marked their appreciation by an intimation that such gallantry is worthy of promotion, and both men are to have the first chance when the opportunity arises.

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10,000 Revolutions a Second

A French scientist has described to the French Academy of Sciences a new machine, the rotating part of which revolves 660,000 times a minute, or practically a million times in a minute and a half.

High-Speed Tube Lifts

Work has commenced on the speeding-up of one of the lifts at Leicester Square, with the object of reducing the time taken by passengers to gain the platforms from the street and vice versa. This experiment is being made with a view to ascertaining what is the best speed at which lifts should run to enable them effectively to deal with modern traffic conditions.

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Testing Bridges

Two years ago a committee was appointed by the Department of Scientific Research to investigate the stresses of bridges. It is now announced that another year will probably elapse before their work is completed. Tests have been made in Yorkshire, in the West of England, and in the Seascale neighbourhood, and the valuable data obtained by the use of improved extensometers will be collated and tabulated during the winter.

Investigations in strains and stresses have been conducted at the same time in India and the United States in order to find a new formula of safety in view of the employment of more massive locomotives and heavier trains. The Committee has been set up at the joint expense of the Ministry of Transport and the railway companies, it being felt that the old formula was no longer applicable to altered conditions.

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Sparkless Loco

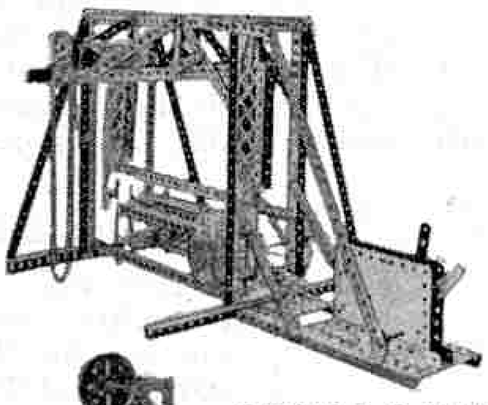
With a view to eliminating the need for ponies in pits, Mr. Charles Markham, of Ringwood Hall, Chesterfield, organised a competition for the best type of electric loco for use underground. For this he offered a prize of £1,000, the judging to be done by the Ministry of Mines.

The prize has now been won by Messrs. Joseph Booth & Bros. Ltd., Union Foundry and Ironworks, Rodley, with a loco 10 ft. in length by 3 ft. 2 in. in breadth. The driver sits in front and the total height to the top of his head, is only 3 ft. 5 in. The loco, which is built in two distinct sections, electrical and mechanical, cost about £700 to construct. It was exhibited at Wembley, and at the Shipping, Engineering and Mechanical Exhibition at Olympia, and we hope to describe it fully in a future issue.

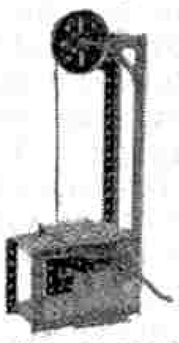
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The Rotor Ship Meets with Disaster

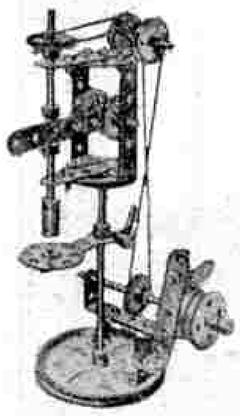
Those readers who read the description of the Flettner Rotor Ship in our issue of last January, will be interested to hear that the vessel constructed by the engineer Struczina at Mulheim, has been in trouble. It appears that the rotor ship was driven by the force of the river current against another vessel, and immediately filled and sank. It is announced, however, that the ship will be raised and repaired, and put in commission again.



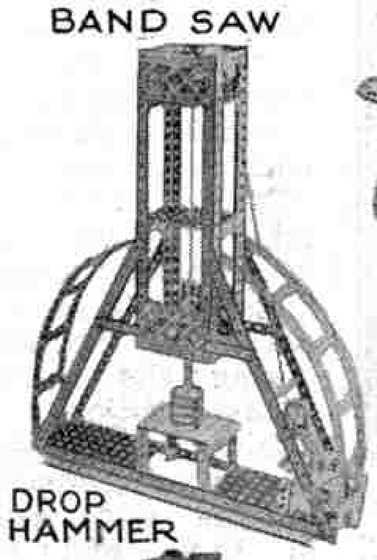
STONE SAWING MACHINE



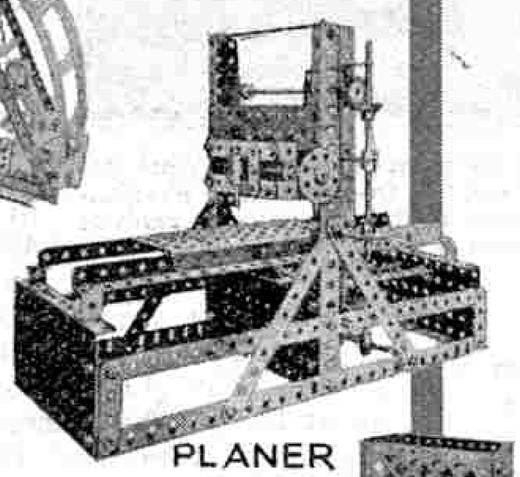
BAND SAW



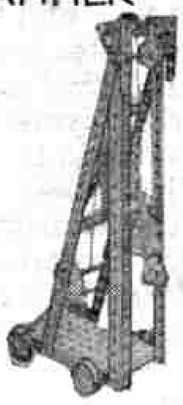
POWER DRILL



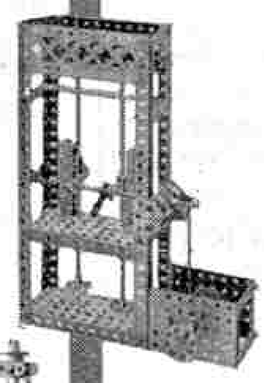
DROP HAMMER



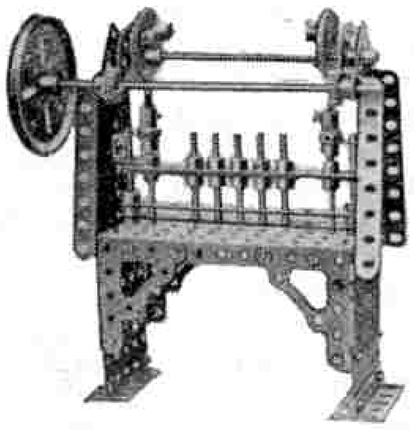
PLANER



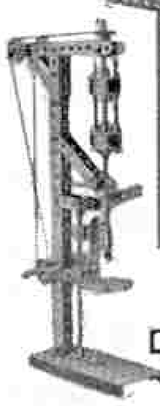
PILE DRIVER



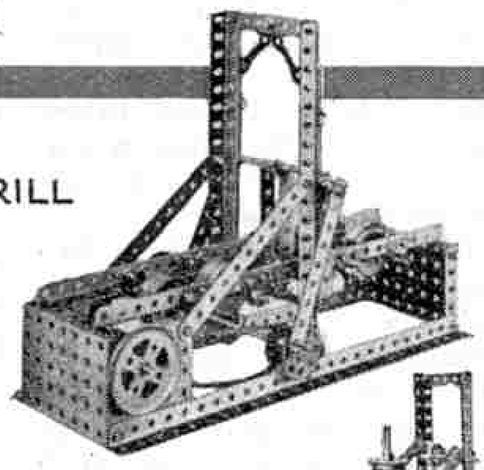
TRIP HAMMER



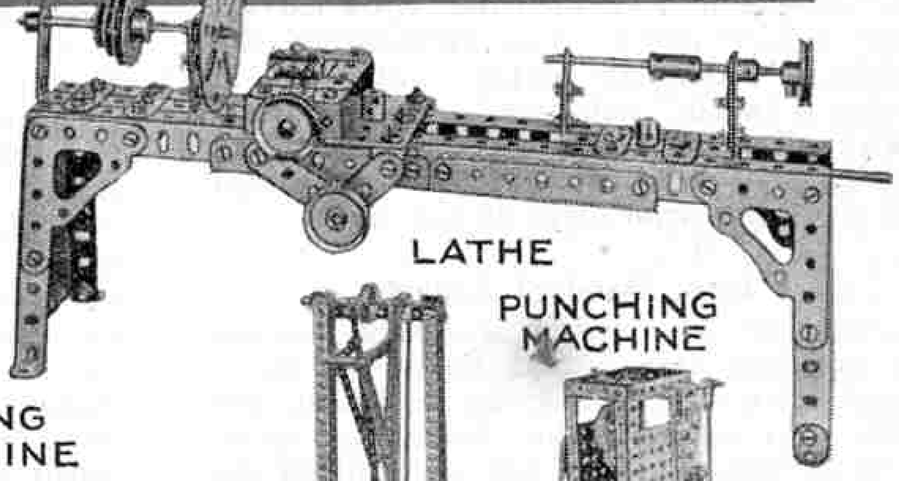
PUNCHING PRESS



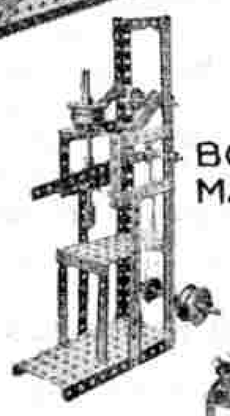
DRILL



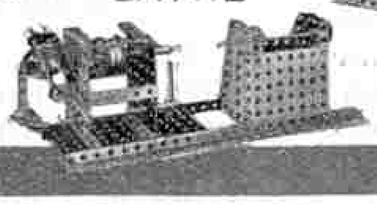
LOG SAW (VERTICAL)



LATHE

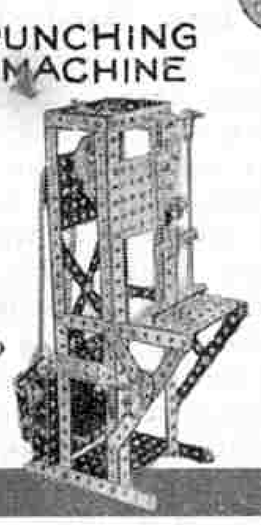


BORING MACHINE

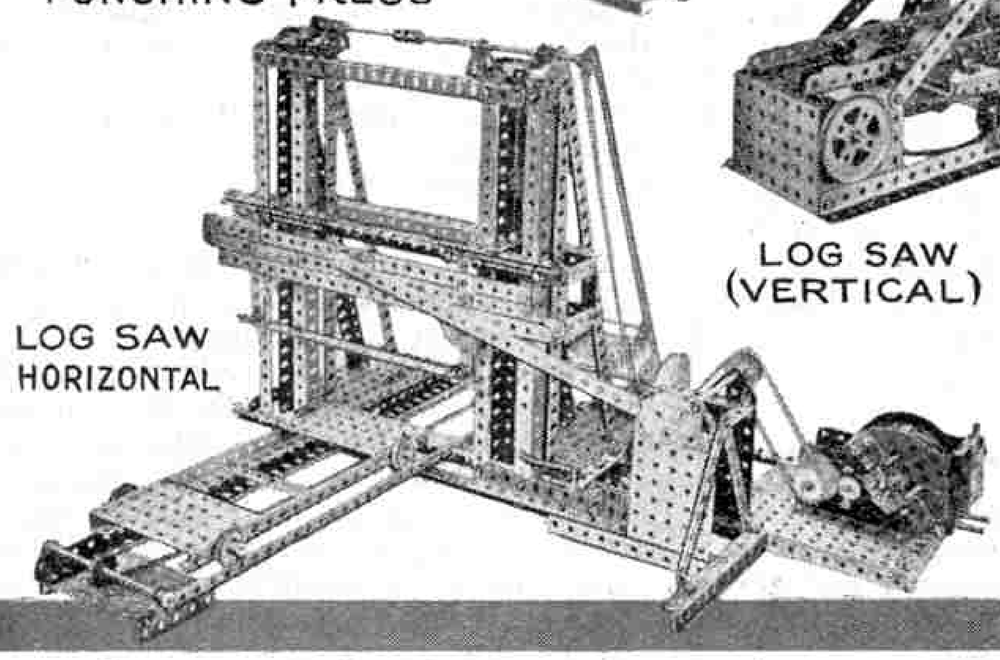


ELLIPTIC LATHE

CIRCULAR SAW



PUNCHING MACHINE



LOG SAW HORIZONTAL

MECCANO

ENGINEERING FOR BOYS

EXAMPLES OF MODEL CONSTRUCTION:

1.—Machine Tools

THERE is nothing more fascinating to every boy interested in engineering than the giant mechanical tools with which the world's great workshops and foundries are equipped. The daily work of some of these great machines would have employed hundreds of men a generation or so ago; their enormous strength has brought into existence the dynamo, steam engine, locomotive, and battleship.

It is interesting to surmise what our earliest ancestors would have thought of a man who could deliver blows of sufficient strength to forge a steel ingot into a liner's crankshaft; yet with a touch of the finger, the operator of a modern power hammer controls a force equal to fifty or sixty foot-tons!

We illustrate a selection of Meccano models, representative of this important branch of engineering. Meccano Machine Tools are not only miniature reproductions of the real thing; they may be *worked* like the real machines. By adding a fretsaw or hacksaw blade to the Sawing Machines, small pieces of wood may be cut through; similarly, by inserting a small twist-drill in the Drilling Machines, holes may be bored through strips of wood, and so on.

MECCANO PRICES

COMPLETE OUTFITS		ACCESSORY OUTFITS	
No. 00	3/6	No. 00a	1/6
No. 0	5/–	No. 0a	4/–
No. 1	8/6	No. 1a	7/6
No. 2	15/–	No. 2a	8/6
No. 3	22/6	No. 3a	18/6
No. 4	40/–	No. 4a	15/–
No. 5 (in well-made carton)	55/–	No. 5a (in well-made carton)	50/–
No. 5 (in superior oak cabinet with lock and key)	85/–	No. 5a (in superior oak cabinet with lock and key)	80/–
No. 6 (in well-made carton)	105/–	No. 6a (in superior oak cabinet with lock and key)	210/–
No. 6 (in superior oak cabinet with lock and key)	140/–		
No. 7 (in superior oak cabinet with lock and key)	370/–		

Meccano Outfits may be obtained from all Leading Toy Stores. Ask to see them.

MECCANO LTD., Binns Road, LIVERPOOL

A NEW MECCANO MODEL

MOTOR-CYCLE AND SIDECAR

WE have received numerous suggestions regarding the construction of a Motor-cycle with Meccano, and in view of the interest that our readers have shown in the idea, we willingly complied with the wishes of many correspondents who requested that particulars of such a model should be published in the "*Meccano Magazine*."

A very interesting model of a "V-twin" motor-cycle and sidecar outfit was sent in by L. Cunningham, of Baxter Avenue, Southend-on-Sea, and the cycle illustrated herewith has been based on the lines suggested by our contributor. The construction of the model should prove to be no light tax on the ingenuity of even long-experienced Meccano boys, and it is undoubtedly a case in which very nimble fingers are called for !

The only item included in the model that is not a regular Meccano part consists of a small elastic band ; this should be about $1\frac{3}{4}''$ in length when fully extended. The novel use of the Curved Strips in the construction of the sidecar, by which a pleasing stream-line effect has been obtained, forms an interesting feature of the model. Both the sidecar and saddle are mounted on springs.

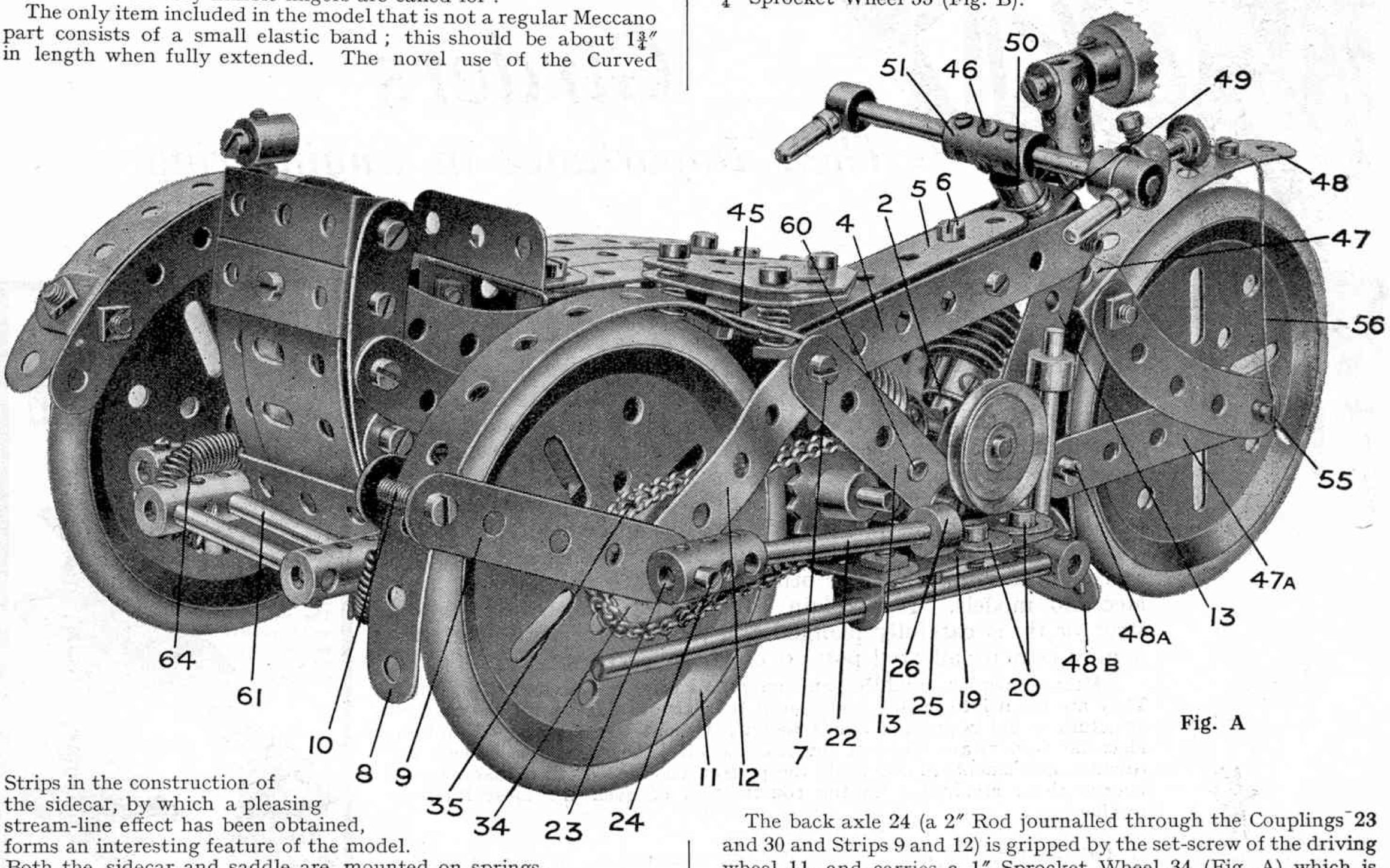


Fig. A

Each engine cylinder consists of a Worm Wheel, secured by its set-screw to the shank of a bolt passed through a Flat Bracket 2 carried from a Double Bracket 3 (Fig. C). The tank consists of two $3\frac{1}{2}''$ Strips 4 (Fig. A) and one 3" Strip 5 held together by Double Brackets at 6 and 7. A $5\frac{1}{2}''$ Strip 8 is bolted by its end hole to the end of the Strip 5, and is bent round as shown to form the rear mudguard. It is clamped in position between two $2\frac{1}{2}''$ Strips 9 by means of a $\frac{3}{4}''$ Bolt 10. The driving wheel 11 is carried in the ends of $2\frac{1}{2}''$ Strips 12, which are bent slightly as shown in Fig. B, as also are the Strips 9.

The V-shaped engine frame is built up from $2\frac{1}{2}''$ Strips 13 converging upon 1" Triangular Plates 14 (Figs. B and C). The side $2\frac{1}{2}''$ Strips have been removed in Fig. C in order to reveal some of the engine details ; normally they are secured by the Bolts 15, 16, 17 and 18. A 2" Flat Girder 19 (Fig. A) is secured to two Angle Brackets 20 bolted to the base of the outer 1" Triangular Plate. A similar Flat Girder 21 (Fig. C) is attached to the first Girder 19 by means of bolts passed through the elongated holes of both girders.

A tie-rod provided on the right-hand side of the machine consists of a $2\frac{1}{2}''$ Rod 22 (Fig. A) nipped in the end of the Coupling 23, in which the back axle 24 is allowed to rotate freely. A Set-screw 25, carrying one Washer, is passed through a hole in the Flat Girder 19, and entering the threaded bore of a Collar 26, grips the Rod 22 fast in position. Another tie-rod of different construction is fitted to the left-hand side of the machine. This comprises a $4\frac{1}{2}''$ Axle Rod 27 (Fig. C) secured to the Flat Girder 21 by means of a Collar and set-screw 28, in a similar manner to that just described. Two Couplings 29 and 30 are mounted on the Rod 27. Coupling 30 forms an additional support for the back axle, and the centre transverse hole of the Coupling 29 is employed as a bearing for a 2" Axle Rod 31 (Fig. B). This Rod 31 carries a $\frac{1}{2}''$ fast Pulley 32 (Fig. C) and a $\frac{3}{4}''$ Sprocket Wheel 33 (Fig. B).

The back axle 24 (a 2" Rod journalled through the Couplings 23 and 30 and Strips 9 and 12) is gripped by the set-screw of the driving wheel 11, and carries a 1" Sprocket Wheel 34 (Fig. A) which is caused to engage with the $\frac{3}{4}''$ Sprocket 33 by means of a Sprocket Chain 35, composed of 39 links. The $\frac{1}{2}''$ Pinion 32 (Fig. C) is connected to the shaft of the flywheel 36 by means of a small rubber band 37, which passes round the groove of the pulley and round the flywheel shaft itself, being guided between a Washer and Collar with set-screw 38. Hence, as the machine runs along, the flywheel is caused to revolve at considerable speed.

A 5" Rod 39 and 2" Rod 40 (Fig. B) represent the exhaust pipe. The Rod 39 passes through the Angle Bracket 41, and is secured in the end of the Coupling 42, representing the silencer ; the 2" Rod 40 is secured in the centre transverse hole of the Coupling 42, while its upper end, passing through the Collar 43, is gripped by its set-screw. The latter, carrying a Washer, passes through the centre hole of the Strip 13 before entering the Collar. The short exhaust pipe 40 is duplicated on the other side of the machine (see Fig. C) ; it should be noted that the Coupling 44 in this illustration is connected to Coupling 42 (Fig. B) by means of a 1" Axle Rod.

The saddle is composed of two Flat Trunnions secured to the

(*Continued on page* 13)



MECCANO ACCESSORY PARTS

Girders

Their Importance in Engineering

The greatest works of engineering depend for their strength and durability upon the massive girders of steel which, though sometimes hidden by an outer casing of masonry, bind them together and hold them rigid. A single rolled steel girder, if properly constructed, proves as strong as a wall of masonry.

The Forth Bridge, a steel highway 1½ miles in length, suspended high above the Forth; the Eiffel Tower, extending almost to the height of a mountain; the Woolworth Building, the tallest skyscraper in New York—these are three of the world's greatest structures that stand like monuments to man's constructive skill. The last named disguises its steel skeleton in a cloak of masonry, but the others tower into the sky like huge Meccano models. It is plain to see how even the smallest strut or tie is carefully planned and placed into position so that it may bear its allotted portion of strain or thrust.

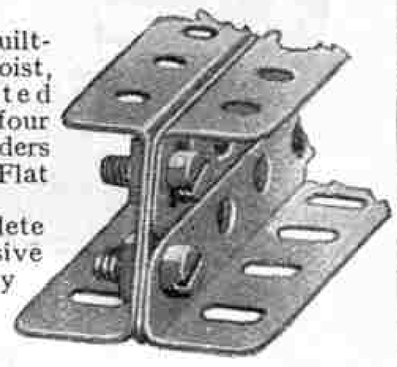
Meccano Girders fulfil the same important duty in Meccano engineering. They are fitted into models and braced by Strips or Rods until the finished structure would support a man's weight, without the slightest disruption. Meccano Girders are made of the finest steel. The edges and corners are rounded and smoothed off, while the perfect accuracy of their manufacture makes them invaluable in the construction of even the most intricate mechanisms.



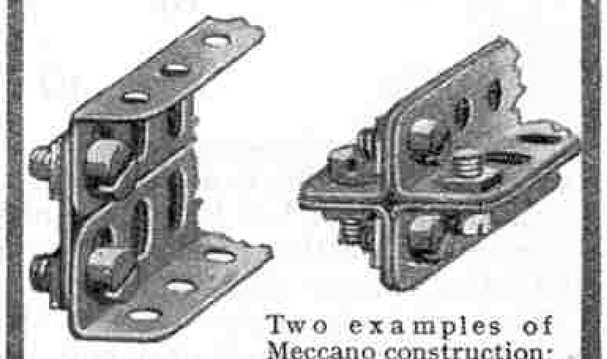
No.			s.	d.
1.	Perforated Strips,	12½″ long ... ½ doz.	1	0
1a.	" "	9½″ " ... "	0	9
1b.	" "	7½″ " ... "	0	8
2.	" "	5½″ " ... "	0	6
2a.	" "	4½″ " ... "	0	5
3.	" "	3½″ " ... "	0	4
4.	" "	3″ " ... "	0	3
5.	" "	2½″ " ... "	0	3
6.	" "	2″ " ... "	0	3
6a.	" "	1½″ " ... "	0	3
7.	Angle Girders,	24½″ long ... each	0	8
7a.	" "	18½″ " ... "	0	6
8.	" "	12½″ " ...½ doz.	1	9
8a.	" "	9½″ " ... "	1	3
8b.	" "	7½″ " ... "	1	2
9.	" "	5½″ " ... "	1	0
9a.	" "	4½″ " ... "	0	10
9b.	" "	3½″ " ... "	0	8
9c.	" "	3″ " ... "	0	8
9d.	" "	2½″ " ... "	0	7
9e.	" "	2″ " ... "	0	6
9f.	" "	1½″ " ... "	0	6

No.			s.	d.
97.	Braced Girders,	3½″ long ...½ doz.	0	9
98.	" "	2½″ " ... "	0	6
99.	" "	12½″ " ... "	1	9
99a.	" "	9½″ " ... "	1	6
100.	" "	5½″ " ... "	1	0
103.	Flat Girders,	5½″ long ... "	1	0
103a.	" "	9½″ " ... "	1	6
103b.	" "	12½″ " ... "	2	0
103c.	" "	4½″ " ... "	0	9
103d.	" "	3½″ " ... "	0	7
103e.	" "	3″ " ... "	0	6
103f.	" "	2½″ " ... "	0	5
103g.	" "	2″ " ... "	0	4
103h.	" "	1½″ " ... "	0	3
103k.	" "	7½″ " ... "	1	3
113.	Girder Frames (triangulated truss type) ...	... ... each	0	2
143.	Circular Girders, 5½″ diam. "L" section	... ... "	1	0

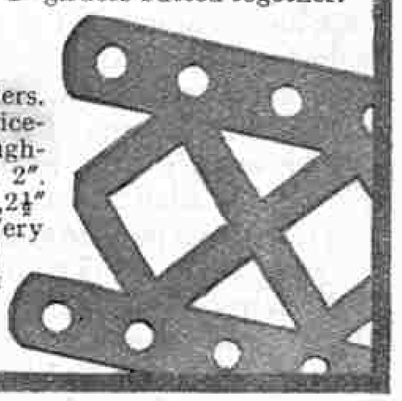
Angle Girders ("L" section, ½″ × ⅝″) In 12 lengths, ranging from 1½″ to 24½″.



Meccano built-up Steel Joist, constructed from four Angle Girders and one Flat Girder. The complete unit is massive and of very great strength.



Two examples of Meccano construction; Channel Section (left) and Cross Section Girders. The latter consists of a pair of "T" girders butted together.



Braced Girders. Stout lattice-work throughout. Width 2″. In 51engths, 2½″ to 12½″. Very ornamental and of great utility.

YOUR DEALER WILL BE PLEASED TO SHOW YOU ALL THE MECCANO PARTS. ASK HIM FOR A COMPLETE PRICE LIST.

MECCANO LTD., BINNS ROAD, LIVERPOOL

Motor-Cycle and Sidecar—(*continued from page* 11)

framework by means of three ½″ Bolts. A 1½″ Strip 45 (Fig. A), bolted transversely to the second hole of the 5½″ Strip 8, forms supports for the rear saddle springs. The small compression springs placed on the three ½″ Bolts are extracted from the Meccano Spring Buffers (Part No. 120a).

The steering column, handle-bars, etc., are constructed as follows : a 2″ Rod 46 is passed through the Fork Piece 47 and its end enters the centre hole of the 5½″ Strip 48, which is bent round to form the front mudguard. A Washer is then placed against the boss of the Fork Piece and the Rod 46 is journalled through two Double Brackets 49, which are placed one within the other and bolted to the ends of the Strips 4 and 13. Three Washers, a Collar 50, and Coupling 51 are then placed in position on the steering column as shown. The handle-bars are built up from Threaded Pins, Collars, and two 1½″ Rods, carried from the Coupling 51.

The head-lamp is composed of a ¾″ Contrate Wheel 52 (Fig. B) secured to the shank of a ¾″ Bolt passed completely through the Coupling 53. The latter is secured to a bolt passed through an Angle Bracket, which, in turn, is secured by a Set-screw 54 to the Collar 50.

The front wheel forks consist of 2½″ Strips 47a (Fig. A) and 2½″ Curved Strips, all of which are slightly splayed to allow free movement of the road wheel. The mudguard 48 is clamped between the Strips 47a by means of a ¾″ Bolt 48a passed through their end holes, in a similar manner to the Bolt 10 on the rear mudguard 8. The set-screw of the front road wheel is removed in order that it may revolve independently of the 1½″ Axle Rod 55. The wheel is held in a central position on its axle by means of a Collar and three Washers mounted within the forks on one side of the wheel to equalise the width of the boss on the other. The mudguard 48 is secured by means of a tie 56. This consists of a Meccano Heald (Part No. 101), the end holes of which are slipped over the axles 55 before the 2½″ Curved Strips are placed in position. The Heald is then doubled beneath the Curved Strip and taken over the Strip 48, and thence down to the opposite end of the axle 55. It is secured to the mudguard by means of a bolt passed through its centre hole. A 1″ Triangular Plate 48b bolted to the second hole of the Strip 48 forms a "splash-guard."

A "Klaxon" horn 57 (Fig. B) is provided. It is constructed from the "ram" of a Meccano Spring Buffer, the screwed end of which engages the threaded bore of a Collar 58 mounted on the handle-bars. A Collar 59 with Set-screw added represents the operating handle and completes the realistic effect.

The undercarriage of the sidecar is built up from a Crank Handle 60 (Fig. D) and 3½″ Rod 61 connected by Couplings and 3½″ Rod 62. Two couplings and a 2″ Rod 63 serve as a luggage carrier, while bolts inserted in the Couplings carry Springs 64, between which the car is suspended. The Springs are attached to the car by means of a 2½″ Rod 65. A Set-screw 66 passed through the bottom of the car enters the threaded bore of a Collar on the Crank Handle 60, so holding the car in its correct position on its cradle.

Each side of the car is composed of the following parts (see Fig. B) : 67, 2½″ and 5½″ Curved Strips overlapped two holes and bolted together ; 68, 2½″ Curved Strips and 3½″ Strips overlapped two holes and bolted together ; 69 and 70, 5½″ Curved Strips. The front ends of all the side members, with the exception of 68, are bolted to a Corner Bracket 71 in the nose of the car. The floor (Fig. D) is composed of two 4½″ Strips 72, a 5½″ Strip 73 and two 2½″ Strips 74, bolted to 1½″ × ½″ Double Angle Strips 75. The top (Fig. B) consists of three 3″ Strips 76, two 2½″ Strips 77 and one 1½″ Strip 78, also secured to 1½″ × ½″ Double Angle Strips. The back is built up from three 1½″ Double Angle Strips, bolted between the corner 2½″ Curved Strips 80, and two 2½″ Flat Girders slightly bent as shown and secured by a bolt 79. All four sides taper towards the nose of the car and are secured to two Double Brackets bolted together by the nut and bolt 81 (Fig. D).

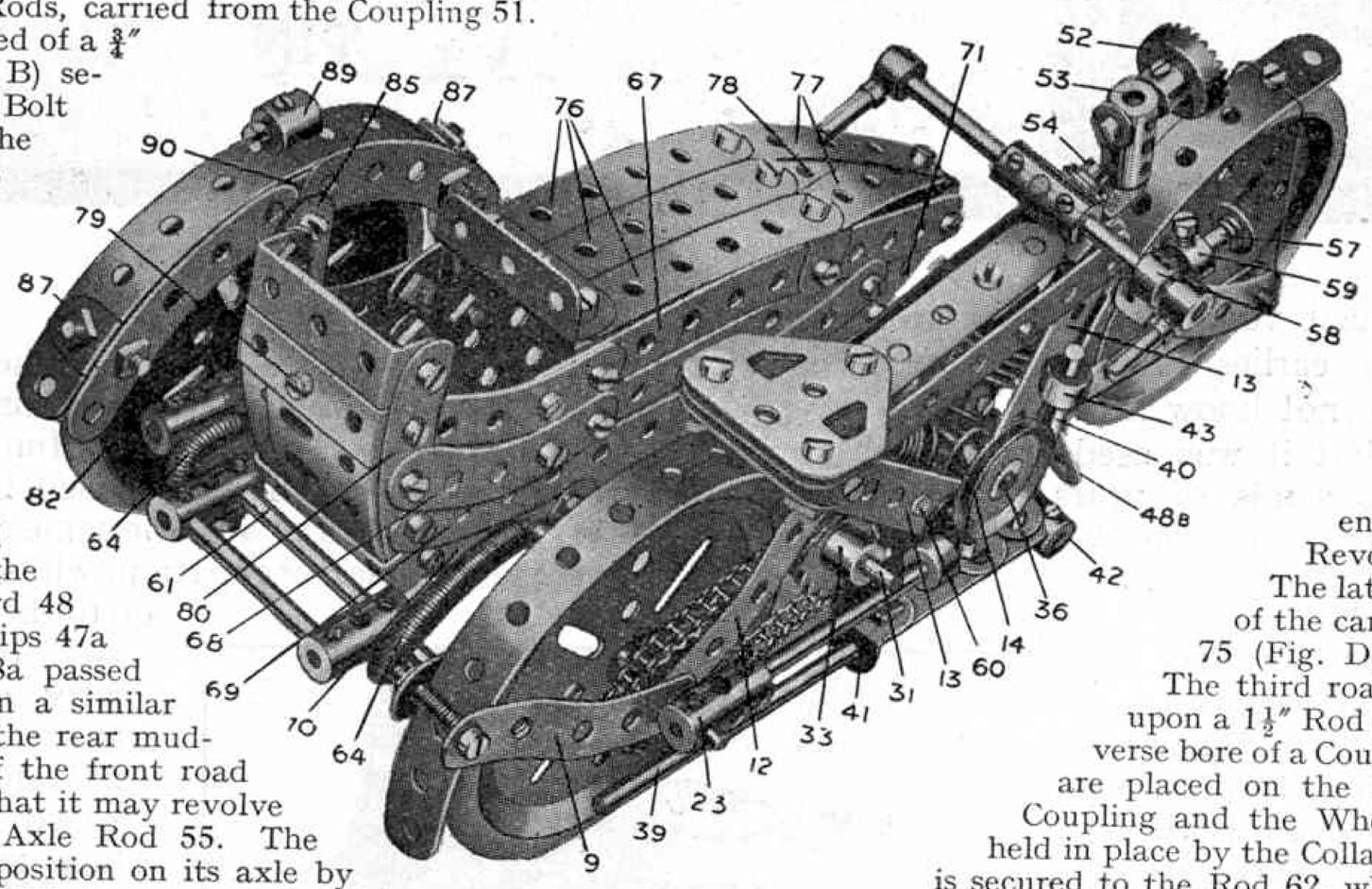


Fig. B

A seat is provided within the sidecar. This is constructed from two 1½″ Flat Girders secured, by means of a bolt passed through the elongated hole in the end of each, to a ½″ Reversed Angle Bracket. The latter is bolted to the floor of the car by means of the screw 75 (Fig. D).

The third road wheel 82 runs freely upon a 1½″ Rod bolted in the top transverse bore of a Coupling 83. Two Washers are placed on the 1½″ Rod between this Coupling and the Wheel, while the latter is held in place by the Collar 84. The Coupling 83 is secured to the Rod 62, which passes through its centre. A 2½″ Strip 85 (Fig. B) is secured to the ½″ Bolt 86 (Fig. D) passed through the lower end of Coupling 83.

The Strip 85 serves to support the mudguard, which is constructed from 5½″ and 2″ Strips overlapped two holes and bolted together. The mudguard is bent round the wheel as shown in Fig. B and carries two 2½″ Curved Strips secured by Angle Brackets 87. A Flat Bracket 88 (Fig. D) is bolted to the end hole of the 2″ Strip, and engages the Rod 62.

The side-lamp 89 consists of a Threaded Boss, screwed to the upturned shank of a bolt which serves to secure the Angle Bracket 90.

The sidecar may be quickly connected or detached from the motor-cycle. The Crank Handle 60 passes through the Strips 13 of the engine-frame (its extreme end is just visible in Figs. A and B), while the Rod 61 enters the end hole of a Coupling 91 (Fig. C), where it is gripped by the set-screw. It will be seen, therefore, that by loosening this screw, the sidecar may be immediately detached and the motor-cycle used as a solo machine, if so desired.

All three wheels are fitted with Meccano Rubber Rings (Part No. 142) to represent pneumatic tyres.

Amongst other features that may be added if desired are a

(*Continued on page* 52)

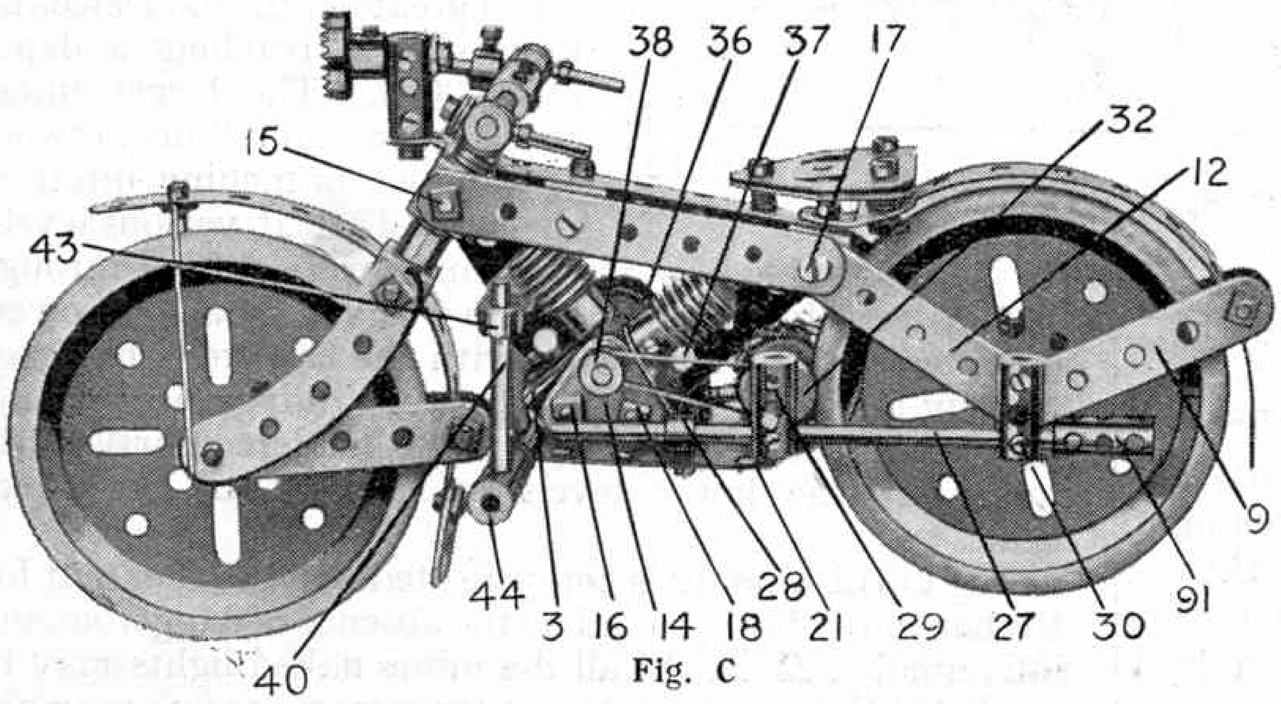


Fig. C

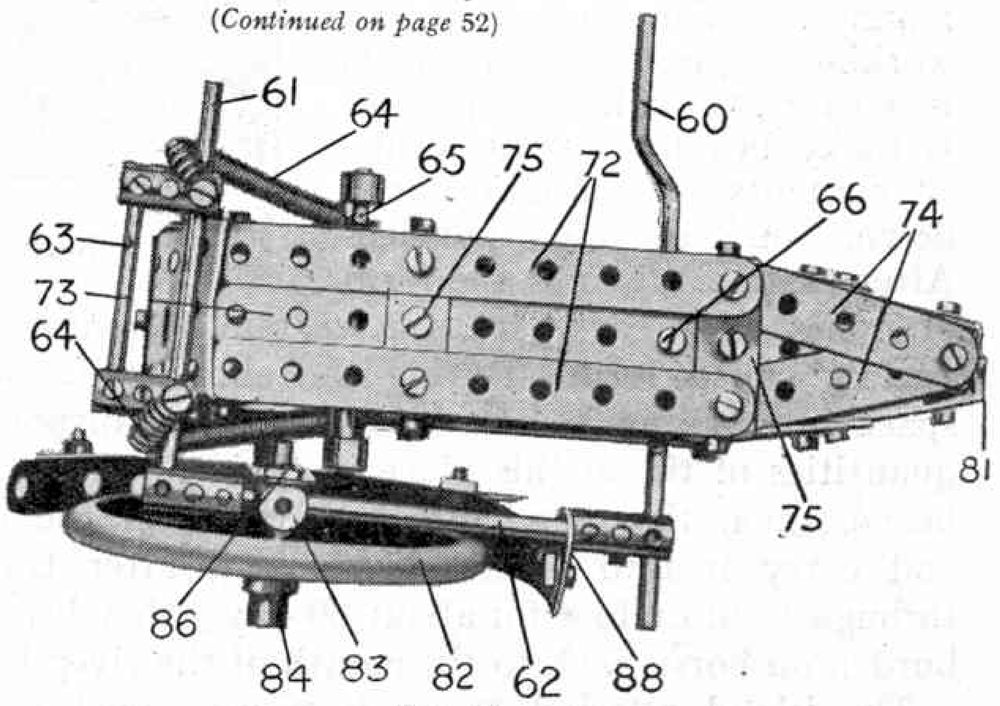


Fig. D



The Story of Metals

VI. TIN.

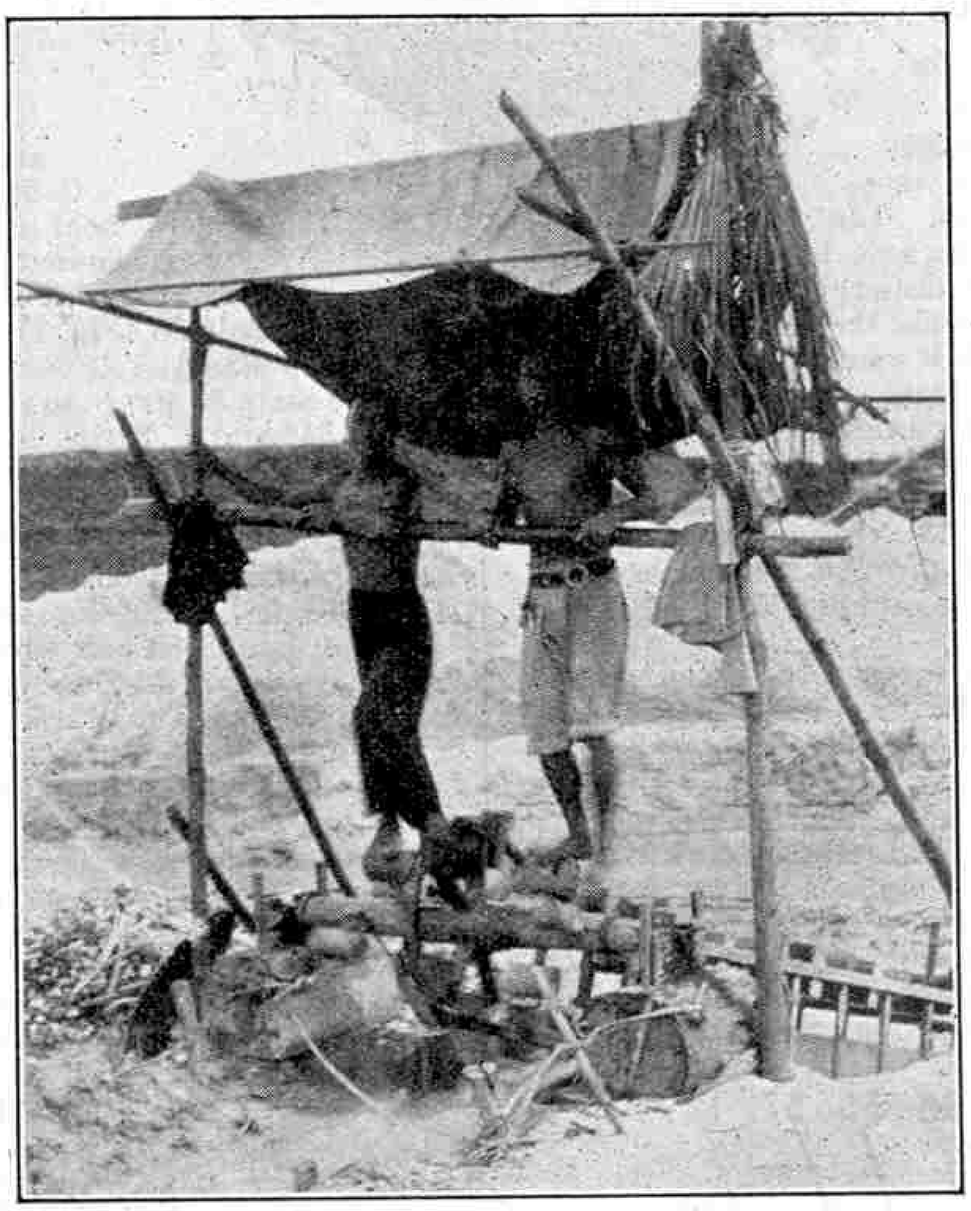
TIN, one of the most valuable of the world's metals, was one of the earliest metals used by prehistoric man. We do not know how tin was discovered, but we do know that it was used along with copper to form bronze thousands of years before the dawn of history. Nothing is known with certainty about the first use of the unalloyed metal.

The earliest reliable records of tin are concerned with the Land's End district of Cornwall, then known as Belerium. The Cassiterides, or Tin Islands, so called from the Greek word for tin, "*cassiteros*," were almost certainly the islands off the Cornish coast, and there is little doubt that it was to Cornwall that the earliest voyagers, the Phœnicians, came to barter various goods for tin.

Early Cornish Mining

One of the most interesting references to Cornish tin was made by Diodorus Siculus, a Greek historian. He writes: "The inhabitants of that extremity of Britain called Belerium excel in hospitality, and through their intercourse with foreign traders live in a civilised manner. They prepare tin, working the earth which yields it with great skill. The ground is rocky but has earthy veins, the contents of which are brought down, melted and purified. After casting this into the form of cubes they carry it to a certain island adjoining Britain called Ictis. During the ebb of the tide the space intervening is left dry and they transport large quantities of tin to this place in their carts. . . . From hence, then, the merchants buy tin from the natives and carry it into Gaul and at last, after travelling through Gaul on foot for about 30 days, they bring their burden on horse-back to the mouth of the river Rhone."

The island referred to as Ictis was most probably St. Michael's Mount situated in Mount's Bay.



Courtesy] **Native Pump at F.M.S. Tin Mine** [*M.S.I.A.*

Decline in Output

From these early days up to the 19th century Cornwall was the most important tin-mining district in the world. According to Mr. Robert Hunt's "*British Mining*," 50,000 tons of tin were raised in Cornwall in the 500 years before Christ and the same quantity during the 500 years of Roman occupation, while the total amount raised up to the year 1880 was 2,116,171 tons. In the 16th century the yearly output of Cornish tin was about 700 tons and between 1860 and 1890 this figure increased to nearly 10,000 tons. Then came a great drop, the output falling in 1899 to about 4,000 tons, and from 50 per cent. or more of the world's tin the Cornish output has steadily declined to only about 4 or 5 per cent. of the total.

Lodes in Granite

In Cornwall the tin is found in association with granite. The extreme hardness of the rock has made mining operations very difficult and as a result of the accumulated experience of centuries the Cornish miner has become famous for his skill and resourcefulness. Many of the Cornish mines are of great depth, the Dalcoath, for instance, reaching a depth of 3,600 ft. The larger mines consist of a marvellous network of galleries branching off from the main shaft at various levels. It is remarkable how these tunnels were driven through the obstinately resisting granite without the aid of power-operated tools. The battle with the hard rock has been won by means of a combination of drilling and blasting. The work is desperately hard and is rendered particularly trying at the lower levels on account of the great heat.

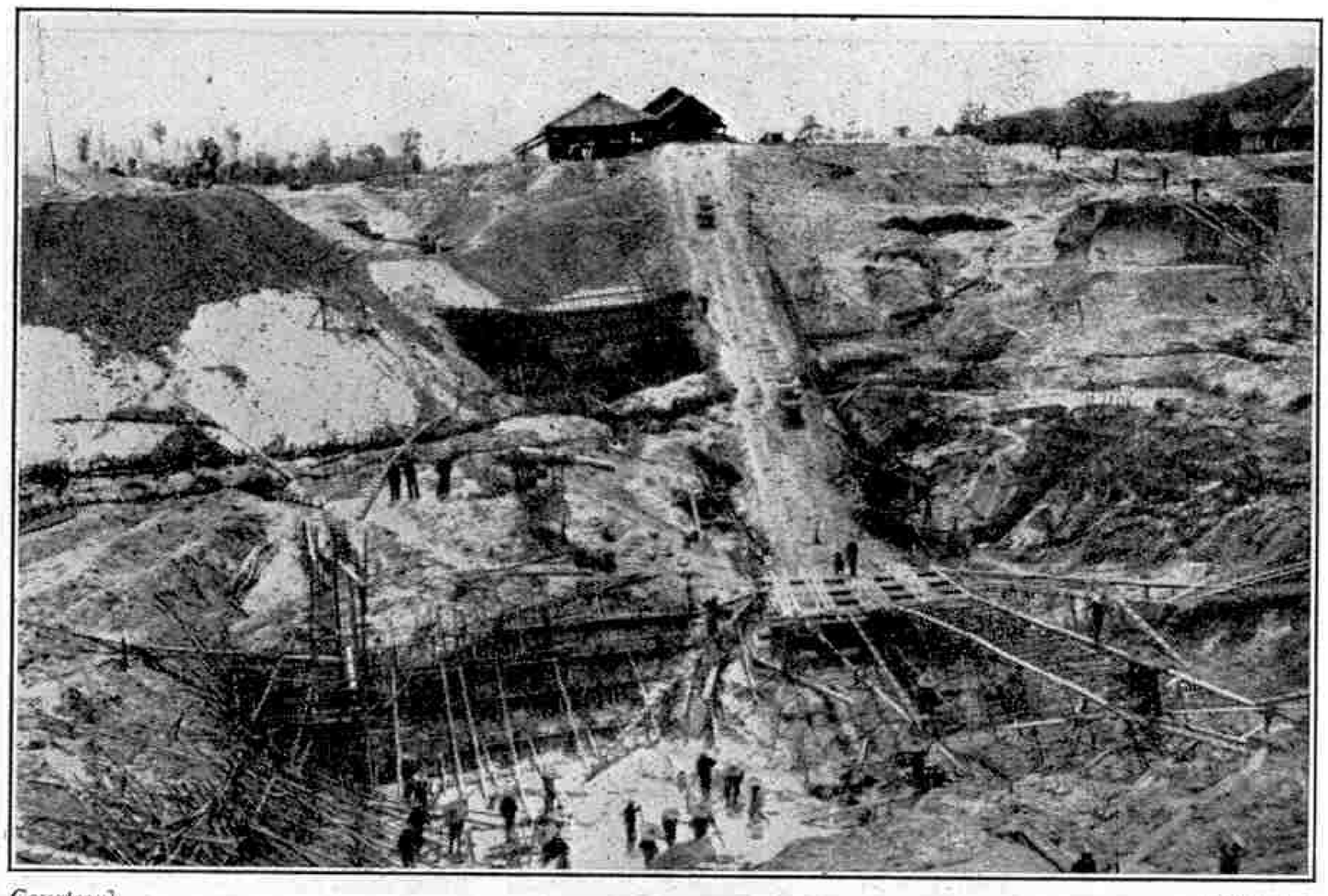
The Cornish miner is compensated to a great extent for the hardness of the ground by the absence of dangerous and inflammable gases. In all the mines naked lights may be carried with perfect safety and the miners are free to smoke

if they wish. The greatest enemy is water, and pumping operations on a very elaborate scale are necessary.

A Visit to a Mine

An interesting description of a visit to a typical mine is given by Mr. C. Lewis Hind in his book "*Days in Cornwall.*" After describing how he was made to remove all his clothing and put on rough, heavy garments specially provided, he tells us how he descended the shaft in an oblong iron box about 7 ft. high by 4 ft. wide, looking like a coffin set upright. "Our journey," he writes, "had lasted about five minutes when the coffin slowed, creaked and stopped; the "captains" [mine officials] stepped out upon a plank laid across darkness, and I, groping after them, emerged in an underground chamber. The floor was heaped high with fragments of ore, just emptied from a tramway, the rails of which stretched away down a dark gallery to the left, water glistening between the rails. In a corner of this chamber the compressed-air engine pumped hoarsely; flaring candles were flattened against the walls; and perched like gnomes upon banks of ore sat some half a dozen miners, eating bread and onions. They were stripped to the waist; the perspiration ran down their bodies and shaped itself into oily little islands and isthmuses upon their broad breasts.

"... at the end of the gallery the atmosphere was hotter and more stifling than ever. Here were more miners in such a state of perspiration that I mechanically wiped my own brow and moistened my lips out of sheer sympathy. I had heard the deep grunt with which they brought their mallets down upon the steel, twenty yards off. Their tools are borers (steel bars two feet long sharpened at the end) and heavy mallets. One man holds the borer pointed towards the rock, while two others swing their hammers over their heads, crashing down in turn upon the end of the steel till it is driven well in. The borer is then withdrawn, and a number of similar holes made, about a hand-stretch apart. Into these cavities dynamite cartridges are slipped, the cap adjusted, the safety fuse attached, the end lighted, and then—well, then the minersscurryaway, and in remote passages seek sanctuary."



Courtesy] [*M.S.I.A.*

Open Cast Chinese Tin Mine, Malaya

In the St.. Just district several of the mines are situated along the cliffs and galleries and follow the ore beneath the sea to distances as great as one mile.

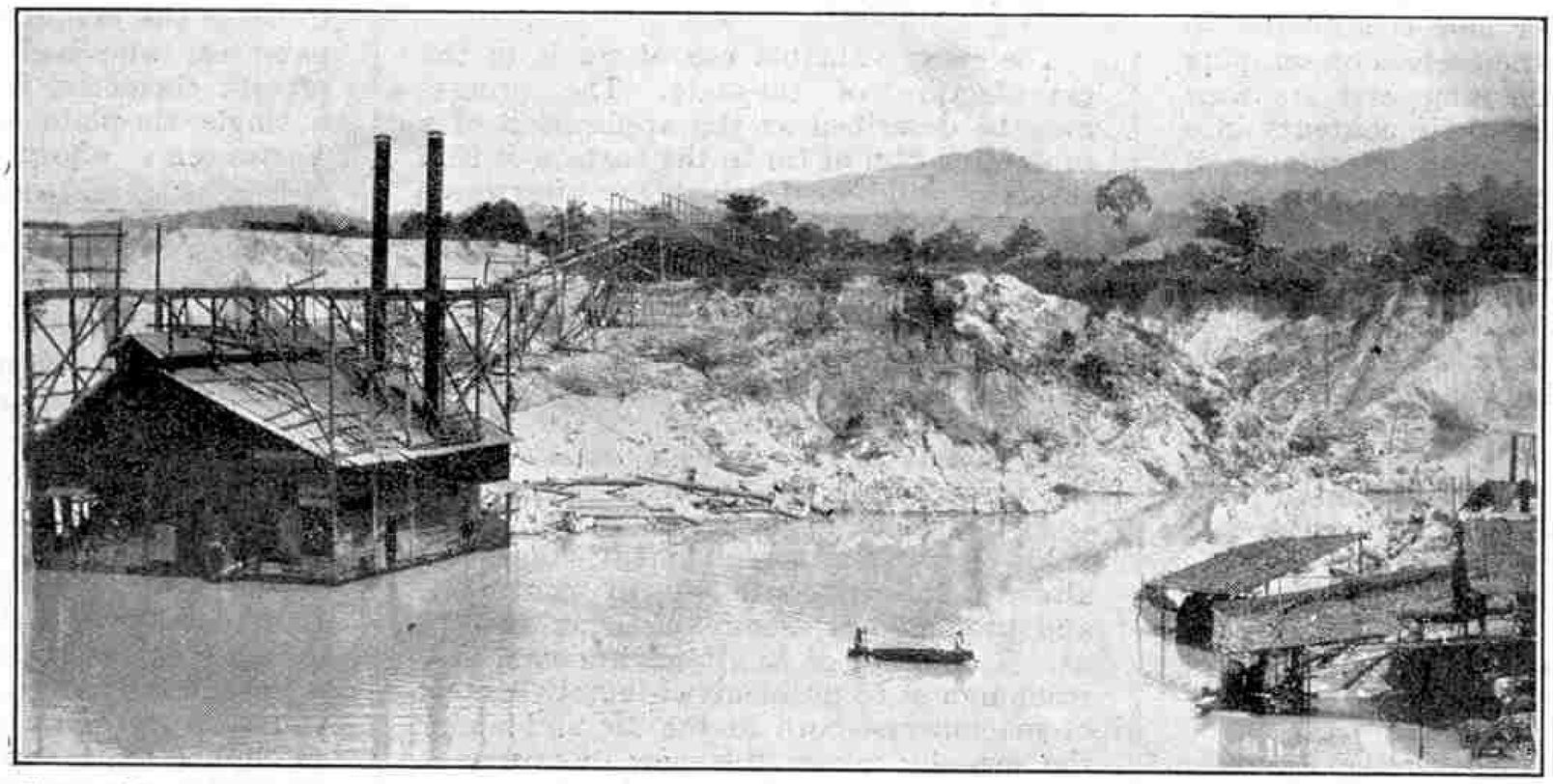
Ore from Malay Peninsula

As we have already seen, the importance of Cornwall as a tin producer has declined, its greatest rival having been the Federated Malay States, which for many years have been the world's largest producer of tin ore. The occurrence of tin in the Malay Peninsula appears to have been known at a very early period. The reliability of some of the earliest references may be doubtful, but it is certain that the Chinese have worked these deposits for many centuries. At one time the mining was almost entirely in the hands of the Chinese and even to-day they produce some 60 per cent. of the total output.

Tin mining in Malaya is carried out in a variety of ways, open-cast mining, "hydraulicing," dredging, etc.

Enormous Excavations

In open-cast mining some enormous excavations have been made. The Sungei Besi Mine, for instance, is 2,180 ft. long, 794 ft. wide and 100 ft. deep. It is estimated that about 5,500,000 cubic yards of ground have been taken out of this mine. The ground is cut by hand labour, using a kind of hoe, and is either lifted by baskets or allowed to fall into trucks which are run by hand or by a light loco-



Courtesy] [*M.S.I.A.*

Suction Dredge in Tin Mine, F.M.S.

motive to inclines up which they are afterwards hauled to the surface. The contents of the trucks are dumped into "puddlers" in which the ore-bearing material is broken up and mixed with water and then sent down sluices in which the ore is caught. Open-cast mining often involves the employment of pumping machinery of considerable power, more especially in the vicinity of limestone.

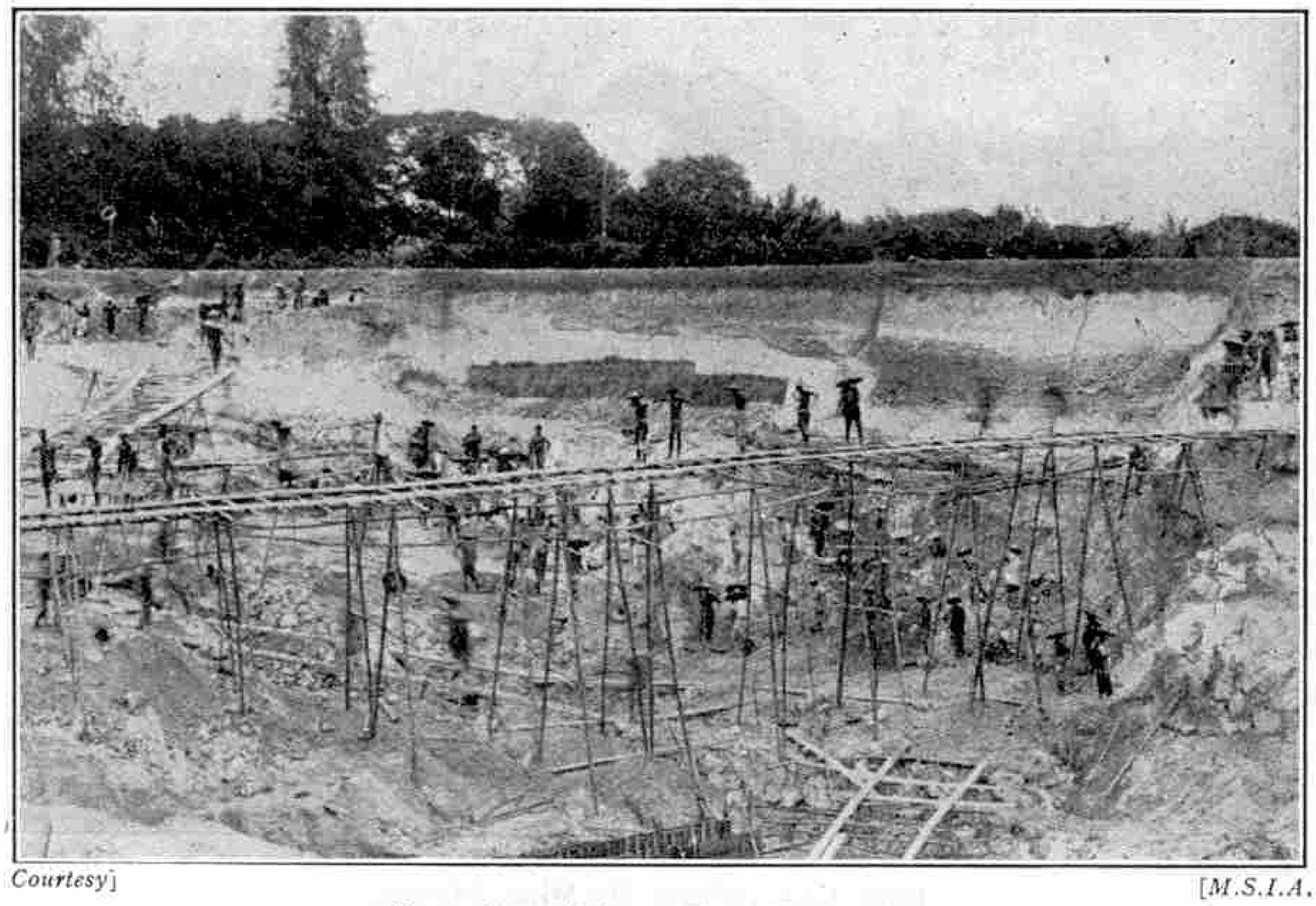
An Interesting Process

The process known as "Hydraulicing" is performed in various ways according to local circumstances. If the water is to be used under natural pressure a dam is constructed in a suitable place in the bed of a stream and raised as much as is required above the level of the mine. The imprisoned water is then sent down pipes to the mine. The water emerges through a nozzle in the form of a pressure jet which is made to play upon the face of the mine, thus cutting it down. The watery mixture produced flows down a sluice where the ore is concentrated. Similar results may be obtained by using water under artificial pressure supplied by a pump. The quantities of water used and the pressures obtained vary considerably. One big pipe line carries 6,000 cu. ft. of water per minute and produces a pressure of 170 lb. per square inch on the mine. Working at this pressure a 3-inch jet would have a potential energy of about 340 h.p.

Dredging

Dredging is mainly carried out by bucket dredges. Steel buckets with capacities of from five to twelve cubic feet are linked up together and this chain of buckets is mounted on a steel ladder with a receiving hopper at its upper end. By revolving the upper wheel upon which the chain of buckets is mounted, the chain is made to move, and the lower end is adjusted so that the buckets fill themselves by scraping along the face of the mine and are then carried up to deposit their contents into the hopper. This method of mining is very successful and it is so cheap that by means of it ground of very low value can be worked profitably.

When the ore in the form of a dark coloured sand has been obtained and cleaned it is filled into canvas bags and sold to one of the local ore buyers. Nearly 90 per cent. of the ore goes to smelteries in Singapore and Penang, the remainder being smelted locally. The resulting metal is known as "Straits Tin," and is peculiarly suitable for use in the tin-plate industry.



Courtesy [*M.S.I.A.*

Open Cast Chinese Tin Mine, Malaya

The first process in the treatment of tin ore consists of roasting it in an iron cylinder rotating over a fire, the object of this being to remove sulphur and arsenic. The ore is then smelted in a reverberatory furnace, tapped off and run into moulds.

Tin has a silver-white colour and a brilliant lustre. It is malleable and ductile and is easily rolled or beaten into foil. It is interesting to note that at a temperature of about 200°C. pure tin becomes so brittle that it may be shattered by a hammer blow! The best quality of commercial tin is extremely pure and frequently contains less than 0.1 per cent. of other metals.

Story of Tin-plate

The most valuable use of tin is in the manufacture of tin-plate. The process may be described as the application of a protective film of tin to the surface of thin sheets of mild steel, which are afterwards utilised for making cans for use as containers for preserved foods, etc., and for making kitchen utensils. The sheets of steel are brought to the required thickness by repeated rollings. They are then cut to suitable size, and "pickled" in warm dilute acid and scraped with sand and water to remove the scale of oxide. After annealing, followed by a further "pickling," the sheets are passed through what is known as a tinning machine. In this machine the plates first pass through a flux of zinc chloride, then through molten tin which adheres to them, and finally emerge through a bath of grease. A final rolling removes any excess of tin and leaves the plates with a bright smooth surface.

The introduction of tin-plate manufacture into England came about in a curious manner. Somewhere about the year 1665 a Worcestershire iron-master named Andrew Yarranton became convinced that it was possible to manufacture tin-plate in England, and thus abolish the country's almost entire dependence upon Saxony for this product. All previous attempts to establish the manufacture had failed and Yarranton realised that no progress could be made until the methods employed in the Saxon industry were discovered. He therefore went to Saxony and was allowed to inspect the process of tinning the plates, and was also permitted to bring back with him to England a number of skilled workmen. In due course he commenced the manufacture and before long produced tin-plate that was of better quality than the Saxon product.

For a little while the new industry flourished, and then some person got a hint as to the method of manufacture and took out a patent for it. The granting of this patent produced an extraordinary situation, for while Yarranton was obliged to cease the manufacture of tin-plate, the patentee, who had not got hold of the process correctly, was unable to produce a single tin-plate that was fit for use! Yarranton's efforts were thus thrown

(*Continued on page* 33)

The Future of the Young Engineer—

(*Continued from page* 39)

by which castings and forgings can be finished accurately from the rough with a remarkable saving in time. We can claim with pride that the British machine tool builder has fought his way back to a premier position in the production of time-saving machine tools. It is for those of you who become Production Engineers to make the best use of these to reduce the cost of engines and machinery of all kinds for home and export, an essential point for Britain in these days of keen international competition.

There are other fields for the Engineer that I can only touch on, and still others that will occur to you but which there is not even time to name. I would refer, for example, to developments in hydraulics and in hydro-electric plants, which, in Europe and America and in our own Dominions such as Canada, are proceeding apace. The repercussive effect of these, with developments in the use of oil, is already felt in our political economy, in the coalfields of this country.

Again, there is the recently discovered field of wireless development, that has already linked continent to continent, and brought our Dominions next door to us. The minds of Engineers are even now reaching out to problems of remote control of machinery—both in the air and under the sea—by use of this new discovery.

In regard to the future, and the opportunities opening out to the young Engineer, therefore, I unhesitatingly declare myself to be an optimist, for in my opinion the opportunities ahead of you are dazzling both in number and extent. In this connection there is one word of advice I would give, however, and that is that when an Engineer is satisfied that he has been thoroughly grounded in the laws that govern mechanical engineering, he should begin to specialise to be successful. When, or how to begin to specialise depends to a great extent on each individual case and the prospects that lie before each man who is completing his training. But whether you specialise on leaving College, or whether an opportunity opens to you in your Engineering practice afterwards, my advice to you is to seize that opportunity when it comes.

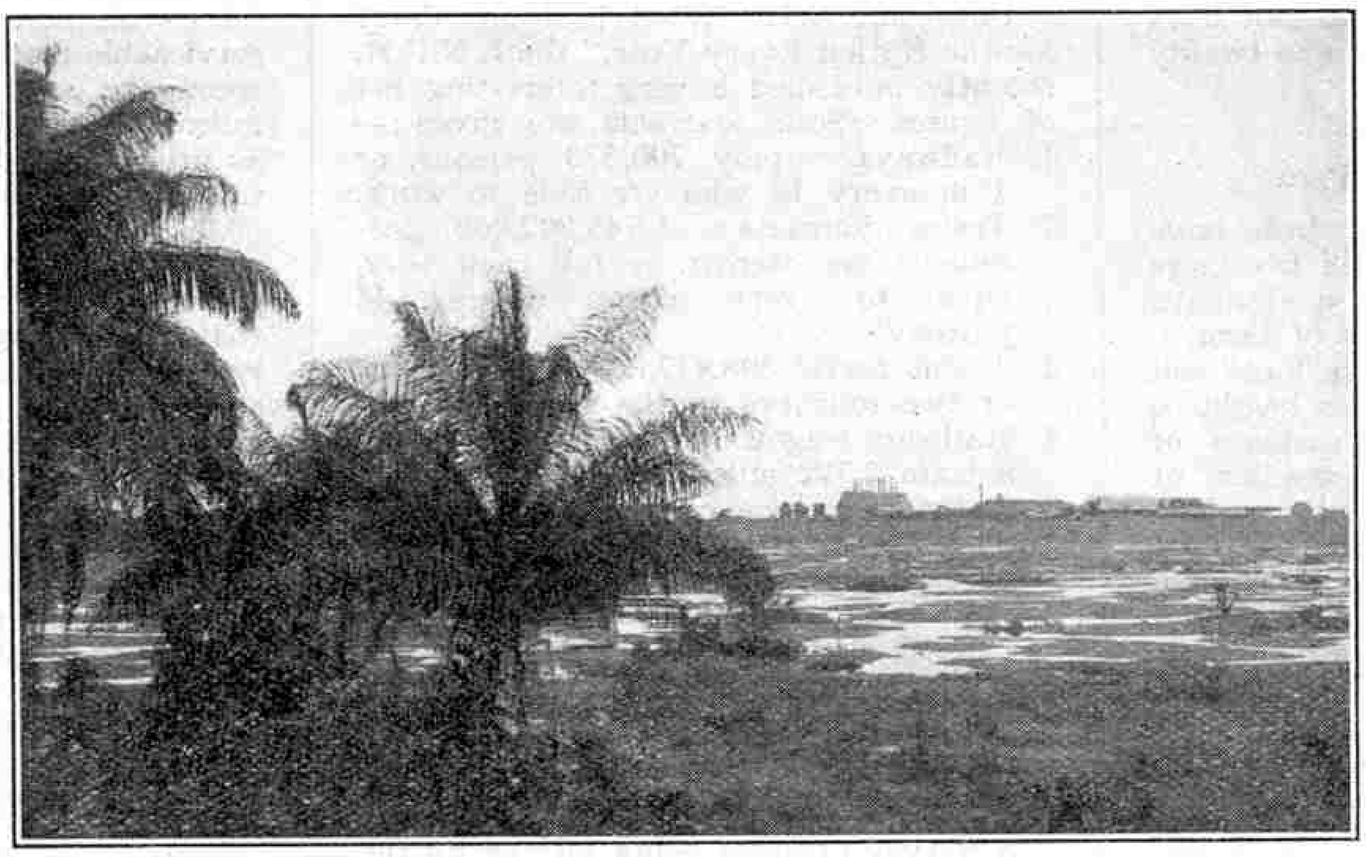


FROM OUR READERS

This page is reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of general interest. These should be written neatly on one side of the paper only, and they may be accompanied by photographs or sketches for use as illustrations. Articles that are published will be paid for at our usual rates. Statements contained in articles submitted for this page are accepted as being sent in good faith, but the Editor takes no responsibility or their accuracy.

The Pitch Lake of Trinidad

The Pitch Lake of Trinidad, from which "Trinidad asphalt" is obtained, is considered to be one of the natural wonders of the world. It is almost impossible to give a description of it that will convey to the reader's mind a correct conception of its actual appearance. It lies stretched out like a savannah or treeless plain, more or less circular and covering an area of 110 acres. The whole surface of this expanse is seamed and scarred by deep fissures filled with water.



The Marvellous Pitch Lake at Trinidad

The general surface of the lake, even during the scorching heat of the day, is no softer or more yielding than an ordinary asphalt pavement under the summer sun. In the centre of the lake, however, where the pitch comes up from the earth, the lightest footstep leaves an impression and you feel yourself almost imperceptibly sinking unless you continue constantly on the move. No doubt there are parts of the lake where, if a man stayed long enough, he would be slowly engulfed. Here and there liquid pitch may be seen oozing out and it may be handled without sticking to the fingers.

The best time to visit the Pitch Lake is in the early morning while it is cool, for during the heat of the day the atmosphere is very oppressive.

It has been estimated that the lake contains 4,500,000 tons of asphalt. This substance is a great source of wealth to Trinidad—indeed the yearly revenue from it pays the total interest charges on the whole public debt of the colony.

The lake probably was discovered by Sir Walter Raleigh, who stated that in coasting along the western shores of the island he found a large quantity of pitch of superior quality, with which he coated over his vessels.

Trinidad was discovered by Columbus in 1496. It remained in Spanish possession until 1797, when a British expedition from Martinique caused its capitulation and it was finally ceded to Great Britain in 1802 by the treaty of Amiens.

EDWARD HOLDER (Port-of-Spain, Trinidad).

Signalling at Severn Bridge

As a regular traveller to and from Lydney via the Severn Bridge, I, along with many others, have wondered how it was possible to avoid accidents on the bridge. Not only do trains travel in both directions on the same line of rails but, in addition, one portion of the bridge frequently has to be swung open to allow ships and barges to pass to and from Gloucester on the canal. On inquiry, I found that there was a wonderful system of signalling in operation between Sharpness and Severn Bridge Station.

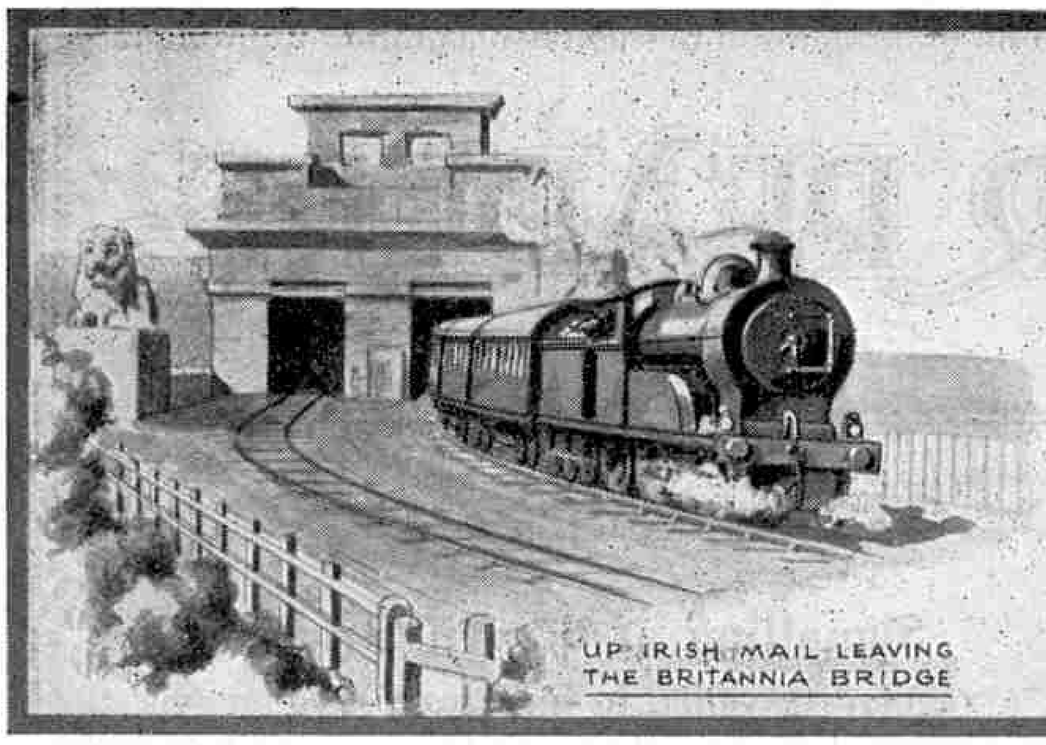
When a train has to cross from Sharpness, the signalman there asks the canal box—an intermediate box at the beginning of the bridge—if the line is clear. If so, he receives the reply: "Line clear, bridge locked." He then asks the Severn Bridge man if all is clear and when this is the case the latter replies "clear," and switches on an electric current that enables the Sharpness man to remove a tablet from a machine in his signal box. This tablet is handed to the driver of the train and he carries it across the bridge and hands it to the Severn Bridge man, who immediately places it in the machine in his box.

No driver can cross the bridge without a tablet and only one tablet at a time can be out of the machine. Further, the swing bridge cannot be opened until the tablet is returned to the machine, and even then only by all three signalmen operating together.

G. BAKER (Newport, Glos.)

William Murdock's Cottage

At Redruth, a town in the mining district of Cornwall, is to be seen an old cottage of great interest to all "*M.M.*" readers, for it was the home of the engineer William Murdock from 1782 to 1798. On the wall is the following inscription :—"William Murdock lived in this house, 1782-1798 ; made the first locomotive here and tested it in 1784, invented gas lighting and used it in this house in 1792." The cottage was partially destroyed by fire but has been renovated and restored as nearly as possible to its original condition. N. A. HILL (Helston).



UP IRISH MAIL LEAVING THE BRITANNIA BRIDGE

Railway News of the Month

A Long Trip on the Buffers

A young apprentice baker of Budapest, wishing to visit Paris without payment of the fare, crawled on to the buffers of a railway carriage and remained in that position until the train, which was not a through express, reached Toulon, when the carriage was detached. He was then observed by the railway police and charged with travelling for four and a half days with no ticket. The sentence was twenty days' imprisonment!

* * * *

Oil-Burning Locos for Peru

The Yorkshire Engine Co. Ltd. have recently completed and shipped five large 4–8–2 type locos built to the standard gauge for the Central Railway of Peru.

The section over which these locos will operate rises from sea level to a height of nearly 16,000 ft., and for a distance of 75 miles there is a continuous gradient of 1 in 25 with many sharp curves. The nature of the line necessitates a very flexible wheelbase, and flanged tyres have been omitted from both the leading and intermediate coupled wheels, which have a diameter of 4 ft. 4 in. Two outside cylinders are employed and the general arrangement of both cylinders and loco frames is in accordance with American practice. The cylinders are 20 in. in diameter and of 28 in. stroke, and the motion rods, of special high-tensile nickel chrome steel, are of light construction.

All fittings are of the most up-to-date design, and include electric head and cab lamps, with a dynamo driven from one of the tender axles. The total weight of each loco and tender is 123 tons 8 cwt., oil fuel apparatus is installed, and the locos are handsomely finished with polished metal bands adorning the boiler and cylinders.

* * * *

S.R. Notes

It was recently stated in these columns that many tank locos of the Southern Railway which were formerly engaged in suburban passenger services, have become unemployed as electrification has been extended. It is now officially announced that a number of the 0–4–4 tankers are for sale.

* * * *

Since the various railways of the Isle of Wight have been taken over by the Southern Railway, the older locos of various types have been largely replaced by more powerful tank locos. These locos were transported from Southampton on lighters and were accompanied across the Solent by the 150-ton floating crane from the port. No difficulty was experienced in performing the interesting tasks of loading and unloading the locos, which are of 0–4–4 type, L. & S.W.R. design.

* * * *

What Railways Carry Each Year

Under the title "What Railways Carry for the Nation Every Year," the L.N.E.R. recently published a very interesting list of figures. Some extracts are given :—

1. Railways employ 700,573 persons, or 1 in every 19 who are able to work.
2. Trains journeys : 1,745,802,000 passengers are carried by rail each year, equal to every person making 44 journeys.
3. Trains travel 398,417,000 miles a year, or two journeys to the sun and back.
4. Railway wagons number 718,610, or a train 2,722 miles long.
5. Railways carry each year 99,398 horses, 3,744,760 cattle, 11,263,357 sheep, 2,347,400 pigs.
6. Coal and Coke : 225,454,000 tons carried each year. Equal to a train of wagons 24,750,000 in number, and 93,749 miles long.

* * * *

Chinese Railway Survey Corps

A Survey Corps is being formed by the Chinese Government to undertake a complete investigation of all the Chinese railway systems. It is intended that the reports shall review all the factors contributing to the success or failure of any line or section, and to enable this to be done the geological and geographical features of every district will be examined. The growth of towns, location of populations, industrial, agricultural and mineral resources, and the general living conditions of the people will each be examined to determine the financial possibilities of opening up new branch lines and providing additional freight facilities.

* * * *

New Pullmans

The Pensylvania Company has ordered fifty all-steel sleeping cars from the Pullman Company of America. The equipment specified by the contract includes shower baths in the dressing compartments, writing desks, telephones and a library. A fully equipped tailor's shop will be added to carry out any necessary repairs to travellers' clothing.

Luxury travel in America is fast reaching the conceivable maximum and almost every possible aid to comfort is installed.

Railway Renewals

Much of the evidence given before the Railway Rates Tribunal was concerned with renewals of stock and material, and we glean many interesting facts.

Mr. Walter Lloyd told the Tribunal that on the Great Western Railway, of which he is Joint Chief Engineer, it was the custom to renew the main and principal lines with new material and employ the serviceable material thus recovered on the secondary and branch lines. Of a total mileage of 6,915 miles, 4,194 are regarded as principal and require new material for renewals, the cost of which is estimated at £3,000 per mile.

Mr. George Ellsom, Deputy Chief Engineer to the Southern Railway, stated that the average life of a single rail is twenty years, but that some of the rails at suburban line junctions last only three months. Maintenance costs are seriously affected by wet weather, which impairs the earthworks and gives rise to disintegration of the permanent way. Landslides are a formidable problem and, at the present time, the Southern Railway is engaged in dealing with over one hundred of them.

Mr. H. N. Gresley, Chief Mechanical Engineer to the L.N.E.R., dealing with the upkeep costs of locomotives and rolling stock, said that the average life of a loco was 33 years and during that period two boilers would be required.

* * * *

Sheffield Station Alterations

Considerable alterations are in hand at the L.N.E.R. Darnall station, Sheffield. The present track, consisting of three double lines, is being supplemented by another track, thus enabling a pair of lines on each side of the station to be used solely by mineral and goods traffic. A subway is to take the place of the existing passenger footbridge and a central island platform will be substituted for the two platforms hitherto in use. The platform booking offices are to be demolished and a new range of buildings erected at the station entrance. The cost of the work will be £36,000.

* * * *

Irish Mail Stop

In future the Irish Mail from Holyhead to Euston will stop at Bletchley each morning to pick up 100 gallons of cream for London. There is no previous record of this famous passenger train stopping to take up dairy produce. No alteration is being made in the running time.

South African News

Three experimental types of locomotives have recently been delivered to the Union of South Africa Railways and are now being tested on the "Union Limited" and "Union Express." These two expresses are booked to cover the 965 miles between Capetown and Johannesburg in 29 hours. The north - bound expresses on this run have to attain an altitude of 5,735 ft., traversing very severe gradients. In some sections inclines are as steep as 1 in 40.

Two of the new types are of American design and were built at the Baldwin Works, Philadelphia. They are of the 4–8–2 (Mountain) and 4–6–2 (Pacific) types and are among the largest locos ever designed for the 3 ft. 6 in. gauge. Each representative has two large outside cylinders. The "Mountain" weighs 227,100 lbs. and the Pacific 192,650 lbs. in working order without the tenders, which are of the well-known American bogie type, not previously used in South Africa. A special feature of each loco is grease lubrication for the coupled wheel axle boxes and crank pins. This method has made possible the extremely long runs now common in America, and it is anticipated that equally good results will be obtained in South Africa.

One of the "Pacific" class has already established what is claimed by the Union of South Africa Railways to be a world's record for the 3 ft. 6 in. gauge. It completed the distance of 965 miles between Johannesburg and Capetown in 27 hours 35 min. actual running time.

The third experimental loco has been built in England and is of the "Garratt" design which is now extending in use very rapidly. It is of the 2–6–2 : 2–6–2 type and is a development of previous "Garratts" supplied by the same builders, Messrs. Beyer, Peacock & Co. Ltd., Gorton. It is to be tested between Capetown and Beaufort West, a distance of 339 miles which includes the Hex River Bank of 16 miles at 1 in 40.

The loco is designed for express work at speeds up to 60 m.p.h., and has coupled wheels 4 ft. 9 ins. in diameter. The four cylinders are 18 ins. diameter by 26 ins. stroke, and the steam pressure is 180 lbs. per sq. in. Total weight of the "Garratt" loco is 147 tons 13¾ cwt., and its greatest width over buffer beams 10 ft. All three locos are fitted with the latest pattern L.M.S. superheater.

* * * *

Progress on the Southern

In addition to the Company's extensive electrification of London suburban lines, the Southern Railway has made notable progress in other directions during 1925.

The advent of the new express locos of the famous "King Arthur" class has resulted in greatly-improved time keeping and the running of considerably heavier trains than ever before on the South Eastern.

During the summer months 13 complete new corridor trains, with six new dining-cars, were placed in service, and several new steamers added to the Company's cross-channel fleet, including the fast new ships "Maid of Kent" and "Isle of Thanet."

The holiday season made great demands upon the Company's resources, and it is computed that no less than 26,000 main line seaside expresses ran to or from London, besides ordinary stopping trains, during the ten weeks of the "rush" season.

* * * *

New Locos for Central Section. Southern Railway

Fourteen new engines of the "King Arthur" class are being built at Eastleigh for use next summer in the South Coast passenger expresses of the Central Section, including the "Southern Belle," etc. The tenders of these locomotives will be the same as those of the No. 810 class Maunsell Mixed Traffic engines. They will be named after the following Knights of the Round Table :—

Sir Ontzlake, Sir Ector de Maris, Sir Dinadan, Sir Dodinas le Savage, Sir Blamor de Ganis, Sir Hectimere, Sir Ironside, Sir Meleaus de Lile, Sir Meliot de Logres, Sir Durnore, Sir Harry le Fise Lake, Sir Cador of Cornwall, Sir Constantine, Sir Galleron.

The name of locomotive No. 788, at present "*Sir Beaumains,*" will be changed to "*Sir Urre of the Mount.*"

* * * *

A Gramophone Record

A Gramophone disc recording the departure of the "Flying Scotsman" from King's Cross has been prepared and includes the sounds of the station bell, the guard's and locomotive whistles and the clatter and rattle of the signals.

Diesel-Electric Locomotives

The Canadian National Railways have been testing new types of cars operated by electricity, produced by a generator placed in the body of the car. Two types have been tried out, one consisting of an articulated body, 102 ft. in length, really made up of two bodies placed on three four-wheel trucks; the other is of a lighter type with a body 60 ft. in length over all and capable of hauling a trailer. One of the lighter cars made the Toronto - Montreal run, 335 miles, in only a slightly longer time than that taken by the regular trains drawn by steam locos.

These experiments with Diesel - electric cars represent an attempt to escape the high fuel cost of coal-burning locos. The first attempts were made with petrol driven cars and, later, storage battery cars were tested over the shorter lines with not altogether satisfactory results. The Diesel-electric was the next step and the Canadian National Railway engineers state that it represents an economical and serviceable type of motive power, well suited to suburban and branch line traffic.

In recent tests these cars averaged one gallon per 4.6 miles, this being about 10 per cent. of the full costs of a steam loco over the same run.

* * * *

Locos Seen at Manchester

During a recent afternoon spent at London Road Station, Manchester (L.M.S. and L.N.E. Railways) the locos seen were of a great variety of designs, as was much of the rolling-stock. Among the former working to and from the L.M.S. side of the station, were "Claughtons," "Princes," and "Georges," while the earlier 4–6–0 and 4–4–0 classes were also represented. An 0–6–0 mixed traffic loco of Midland type, though built this year at Crewe, worked out with a local train, and an express from the Potteries came in behind a North Stafford 0–6–4 tanker. A Midland compound passenger engine was also in evidence.

On the L.N.E. side a heavy express left for London drawn by a Great Central 4–6–0 of the "Sir Sam Fay" class, while the same section of the L.N.E.R. was represented as well by 4–4–0 "Directors," 0–6–0's, and very many 4–4–2 and 2–4–2 tanks which work suburban trains. One of the new 0–6–2 tanks of Great Eastern design, but with standard funnel and fittings, also left with a stopping train.

Amongst interesting combinations of rolling-stock there was a former Highland Railway bogie coach working on the Buxton (L.M.S.) expresses.

An Unusual Load

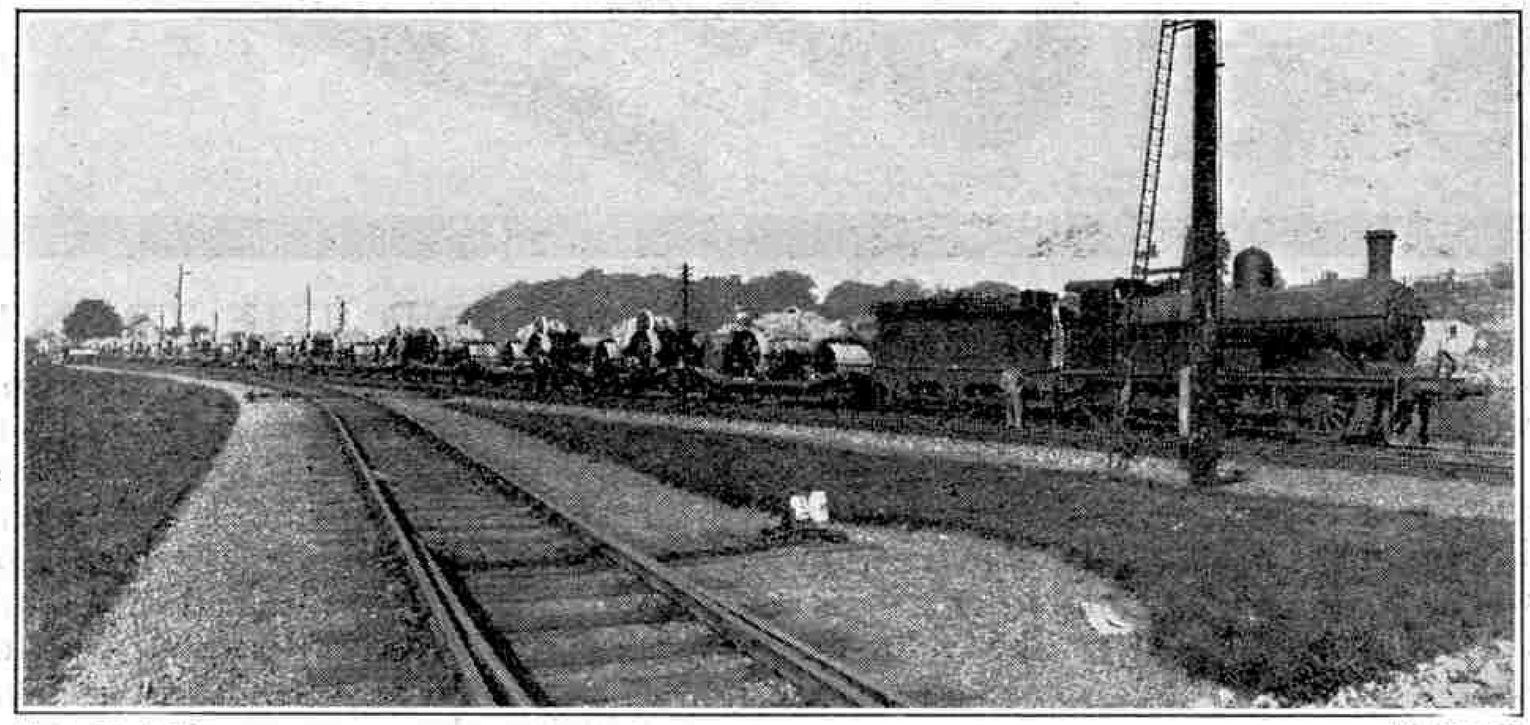
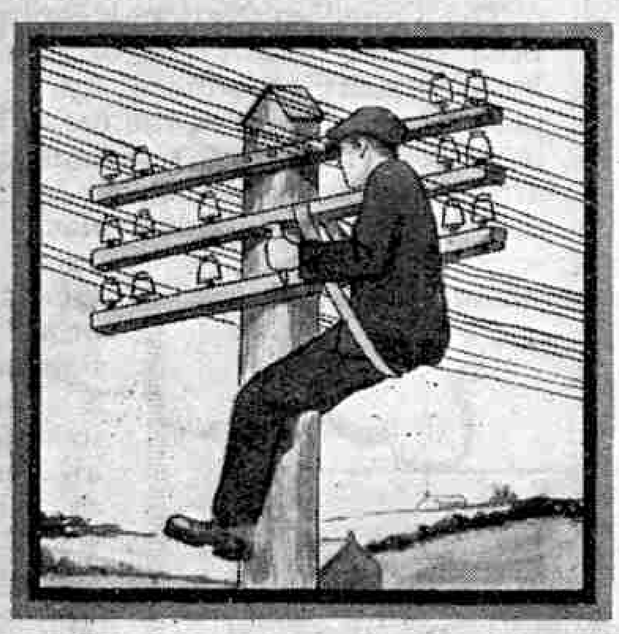


Photo courtesy] [*L.N.E.R.*

Our photograph shows a train load of 20 "Marshall" steam road rollers, each of which is carried on a special type of wagon, leaving Gainsborough by the L.N.E. Railway for shipment to Hull. These rollers are part of an order for 100 steam road rollers placed by the Greek Government for the great road reconstruction scheme in that country.



Electricity

XXII. THE TELEPHONE—THE RECEIVER AND THE TRANSMITTER

LAST month we described the invention of the telephone by Alexander Graham Bell and of the microphone by Thomas Edison. Before we discuss the improvements that have been made since their time, it will be useful to examine the construction and methods of working of the original instruments. We shall then be able to realise better the value of the modern types.

Bell's Original Instrument

An adaptation of one of the figures in the original patent taken out by Bell on 7th March 1876, is shown in Fig. 1, and it demonstrates very clearly the working of the first model. Two of these instruments are used, one for transmitting and the other for receiving. The magnet coils are connected together by means of copper wires, one of which is broken to permit the inclusion of a battery in the circuit. Thus current flows from the battery through each coil and back to the battery.

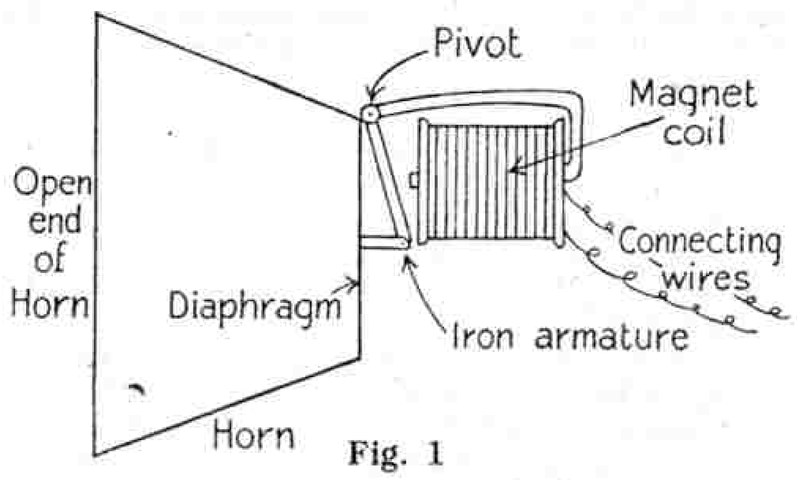


Fig. 1

In order to operate the instrument it was necessary to speak into the horn, thus causing sound waves to strike the diaphragm stretched across the narrower end of the horn. This diaphragm was a piece of gold-beater's skin, tightly stretched yet pliable and elastic, and it moved in and out in almost exact accordance with the sound waves that impinged upon it. In this manner the sound was converted into mechanical movement.

By means of a short rod, a soft iron armature, pivoted as shown in the figure, was attached to the centre of the diaphragm. This armature was placed immediately in front of one pole of the electro-magnet, the other pole of which was magnetically connected with the other end of the armature through its pivot.

When the circuit was completed, by connecting the coils and the battery in series as already described, the core of the electro-magnet became strongly magnetised, as also did the iron armature owing to its proximity to the electro-magnet. Thus there was produced a very strong magnetic "field,"—that is a space in which a strong magnetic influence exists—between the armature and the core of the magnet.

How the Sound is Reproduced

When the diaphragm vibrated owing to some sound being made in front of it, the armature moved to and fro on its pivot. When a magnet is moved across a strong magnetic field in which there is a coil of wire, a minute electric current is set up in that coil, and thus there was induced in the magnet coil a fluctuating electric current in accordance with the original sound. This fluctuating current is of course quite distinct from the constant current from the battery employed in producing the magnetism.

The fluctuations of current passed through the coil of the receiver and varied the strength of the pull exerted by the magnet core upon the iron armature. Consequently the iron armature moved towards or away from the core according to whether the magnetic attraction had been increased or decreased. These movements were communicated to the diaphragm and thus produced corresponding sound waves. In this manner the original sound made before the first diaphragm was reproduced at the second diaphragm.

This is the principle upon which the first telephone operated and any reader who possesses a couple of wireless headphones can test it for himself. No battery is required in this case, for the magnets in the head-phones are permanent magnets. Connect the two wires from one pair of 'phones to the two wires from the other pair by means of two insulated copper wires, and persuade someone to speak into one pair while you listen with the other. You will then hear his voice reproduced clearly but faintly. You should, of course, be too far from the speaker for you to hear what he says directly through the air.

Louder Signals Needed

The great defect of the Bell telephone lay in the extreme weakness of the reproduced sounds, and it was with the object of obtaining louder signals that Edison turned his attention to inventing an improved transmitter. It was obvious that, if louder signals were to be obtained, the variations in the current would have to be larger, and it seemed impossible to accomplish this by means of one magnet moving in front of the pole of another. Accordingly Edison turned his attention to other methods and in the end invented the carbon microphone. His original transmitter is shown diagrammatically in Fig. 2. There were the usual mouth-

piece and diaphragm and behind the latter was a button pressing against the front contact, to which one of the line wires was attached. Behind the front contact was a thin slab of compressed carbon, and behind this again the back contact, to which the other line wire was attached.

The current supplied by the battery had to pass from one of the contacts to the other and it was found that, as the front contact moved in and out in accordance with the movements of the diaphragm, so the resistance of this part of the path of the current varied. An instrument of greatly increased sensitiveness was thus produced for converting sound waves into fluctuations of an electric current.

Previously the fluctuating current had been actually made in the transmitter itself, by the moving magnet, but now the source of power was removed from the transmitter to the battery, and the transmitter itself merely acted as a kind of tap to control the amount of electricity that was flowing.

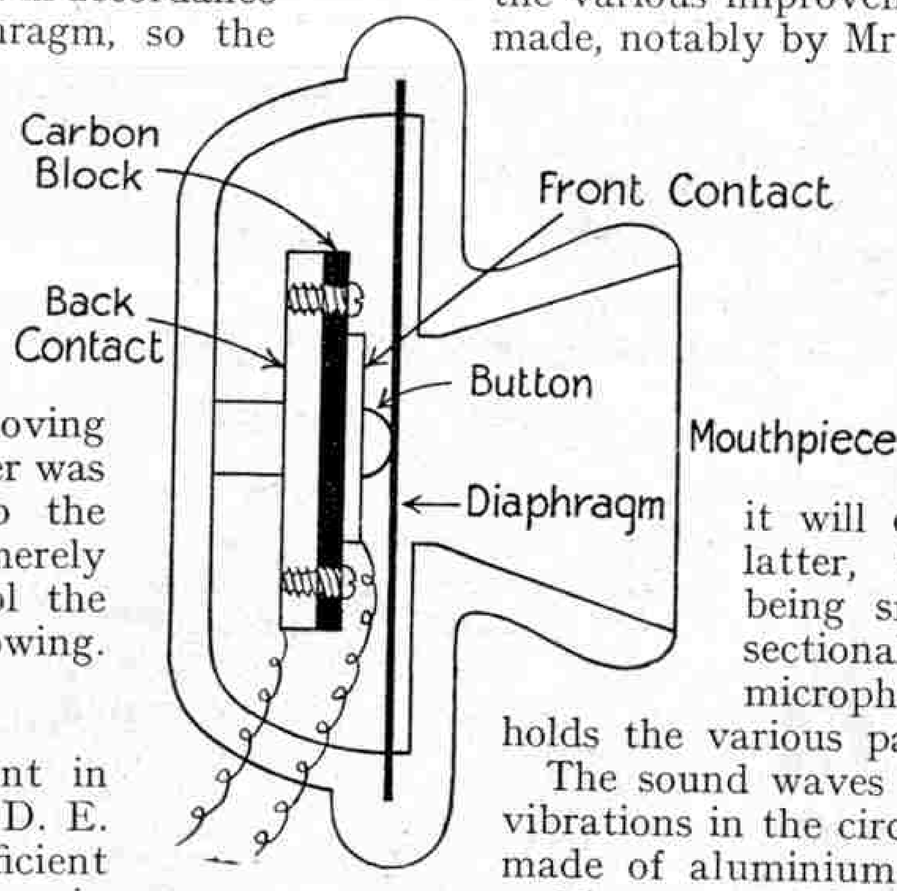


Fig. 2

The Hughes Microphone

The next important improvement in this direction was due to Professor D. E. Hughes, who produced a very efficient microphone in 1878. Hughes was born in London in 1831 but his parents went to America when he was seven years old, taking him with them. He was trained for the musical profession but soon left this to supervise the manufacture of a printing telegraph that he had invented. This telegraph subsequently came into use throughout America and Europe. Hughes died in London in June 1900.

In the Hughes microphone two pieces of hard carbon pressed lightly against one another and an electric current was passed through this point of contact. The same current also passed through the magnet-coil of a telephone receiver. Of these two carbon electrodes, one was placed on a sounding board while the other apparently merely rested on the first. When the sounding board vibrated under the action of air waves the resistance of the contact varied in rough proportion to the amount of vibration. This microphone was extremely easy to construct and it was found that it made little difference what the two contacts were made of, providing the electrical contact was sufficiently poor.

Further Improvements

The next microphone of importance was an improvement of the same type as the Hughes microphone, and was invented by an American, Francis Blake. In this transmitter a platinum point was pressed on the centre of the diaphragm at the back and against this a small piece of carbon was pressed by means of a spring about 1/100 in. thick and $\frac{1}{8}$ in. in breadth. The force exerted by this spring against the platinum point could be varied by means of an adjusting screw, and the resistance of the contact varied in the same way as in the previous instruments. This microphone became very popular in America. The quality of its reproduction was excellent in every way but it did not give signals of sufficient loudness.

In this country considerable attention was paid to multi-contact microphones in which four, six or even twelve pairs of contacts were employed. These gave much louder signals, but the tone was rather harsh, and ultimately these and the Blake microphone gave way before the Hunnings transmitter, invented in 1878, and the various improvements upon it that have since been made, notably by Mr. A. C. White, the inventor of what is known as the "solid-back" transmitter, which is the type in use everywhere at the present time.

Solid-Back Transmitter

The Hunnings transmitter was extremely simple and based upon the same principle as the present solid-back transmitter, so that it will only be necessary to describe the latter, the difference between the two being small. In Fig. 3 we illustrate a sectional diagram of a modern solid-back microphone with the outer framework that holds the various parts in place removed.

The sound waves entering the mouthpiece A set up vibrations in the circular diaphragm B, which is usually made of aluminium and about $2\frac{1}{2}$ inches in diameter and is supported in the framework, being separated from it by a rubber cushion C folded over its edge.

Rigidly attached to the outer framework is the bridge D of brass, which carries the cup E, also of brass, by means of an adjusting rod F. The inside of this cup E is lined with paper, but a solid disc of carbon G, attached to the bottom of the cup, is electrically connected with the framework of the cup. Across the top of the cup a thin sheet of mica H is stretched, being firmly secured to the rim by means of the brass clamping ring J. In the centre of the mica disc H is a hole through which the rod K, rigidly attached to the diaphragm B, is passed, being secured to the mica by means of a nut. The inner end of this rod K carries a brass disc L, nearly the width of the cup, and to which is attached a hard carbon disc M similar in every way to the lower carbon disc G.

The cup is filled three-quarters full with finely ground carbon granules and the circuit through the microphone is from one carbon disc through the granules to the other carbon disc.

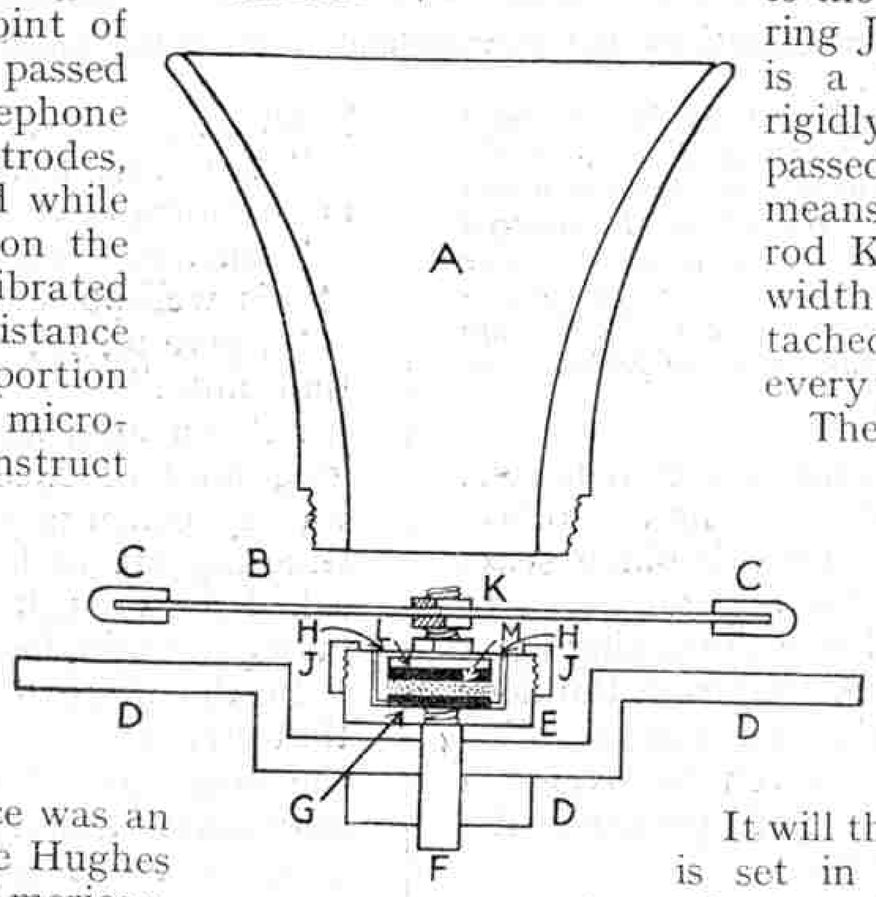


Fig. 3

How the Microphone Controls the Current

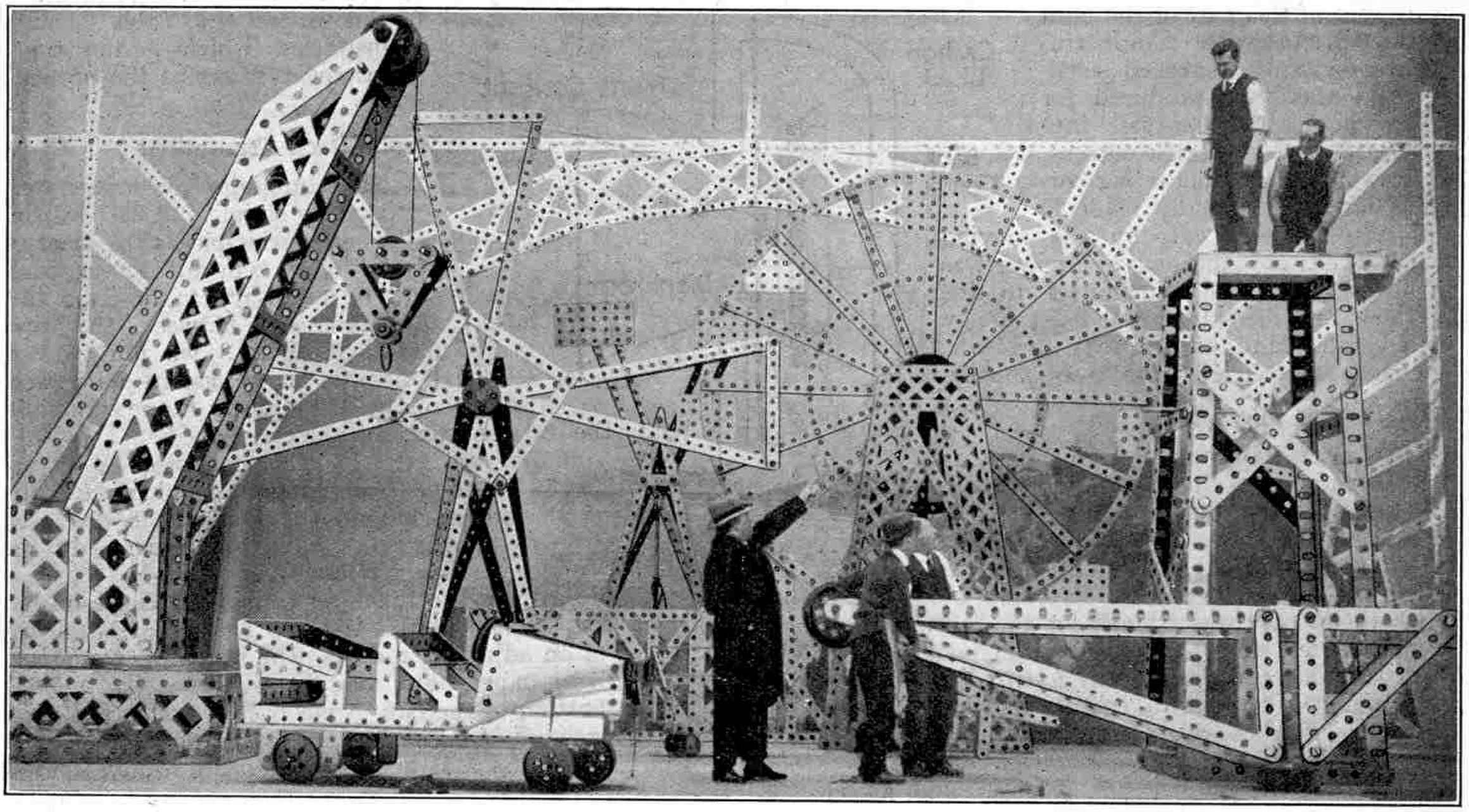
It will thus be seen that when the diaphragm is set in vibration the upper carbon will vibrate with it, since the two are rigidly connected together, and so the carbon granules in the box will be more or less compressed according to the amplitude and form of the vibrations. It is found that when the granules are compressed the resistance of the instrument falls very considerably, and so a fluctuating electric current is produced in the circuit. These fluctuations act upon the receiver and so cause it to reproduce the original sound with an accuracy

(Continued on page 53)

Giant Meccano Models

Preparing the Scenes for the Christmas Pantomime

By W. Henry



Building the Giant Models for the Meccanoland Scene at the Empire Theatre, Liverpool

The announcement in the November Magazine of the Meccanoland scene in the Wylie-Tate Pantomime, "The Sleeping Beauty," at the Empire Theatre Liverpool, aroused great interest and large numbers of readers promptly wrote to ask for more particulars. I arranged therefore for a special correspondent to meet Mr. Wylie at the theatre to spend a couple of hours in watching the preparations for this wonderful pantomime. In the following article readers of the "M.M." are given a "peep behind the scenes" of a great pantomime in preparation. —EDITOR.

* * * *

NOT knowing which entrance I was expected to use, I made for the doorway leading to the box office, where alert attendants were busy booking seats for a constant stream of people. Nobody appeared to have time to bother about me and I was wondering what to do when a voice apparently proceeding from the floor behind me said "Can I do anything for you sir?"

I swung round and after careful search discovered a diminutive blue boy in buttons, not, perhaps, the smallest ever, but getting on that way.

"My lad," I enquired, "do they use a shoe horn to lever you into those garments?"

He drew himself up to the fullest extent of his smallness. "Sir," he said with dignity, "You must not ask me to divulge a professional secret."

"Right, my lad. Now I want you to find Mr. Wylie and give him this note—that is if you are big enough to carry it!"

"I am stronger than I look, sir. I once carried one hundred pounds."

"Yes, but that hundred pounds might have been in the form of a cheque."

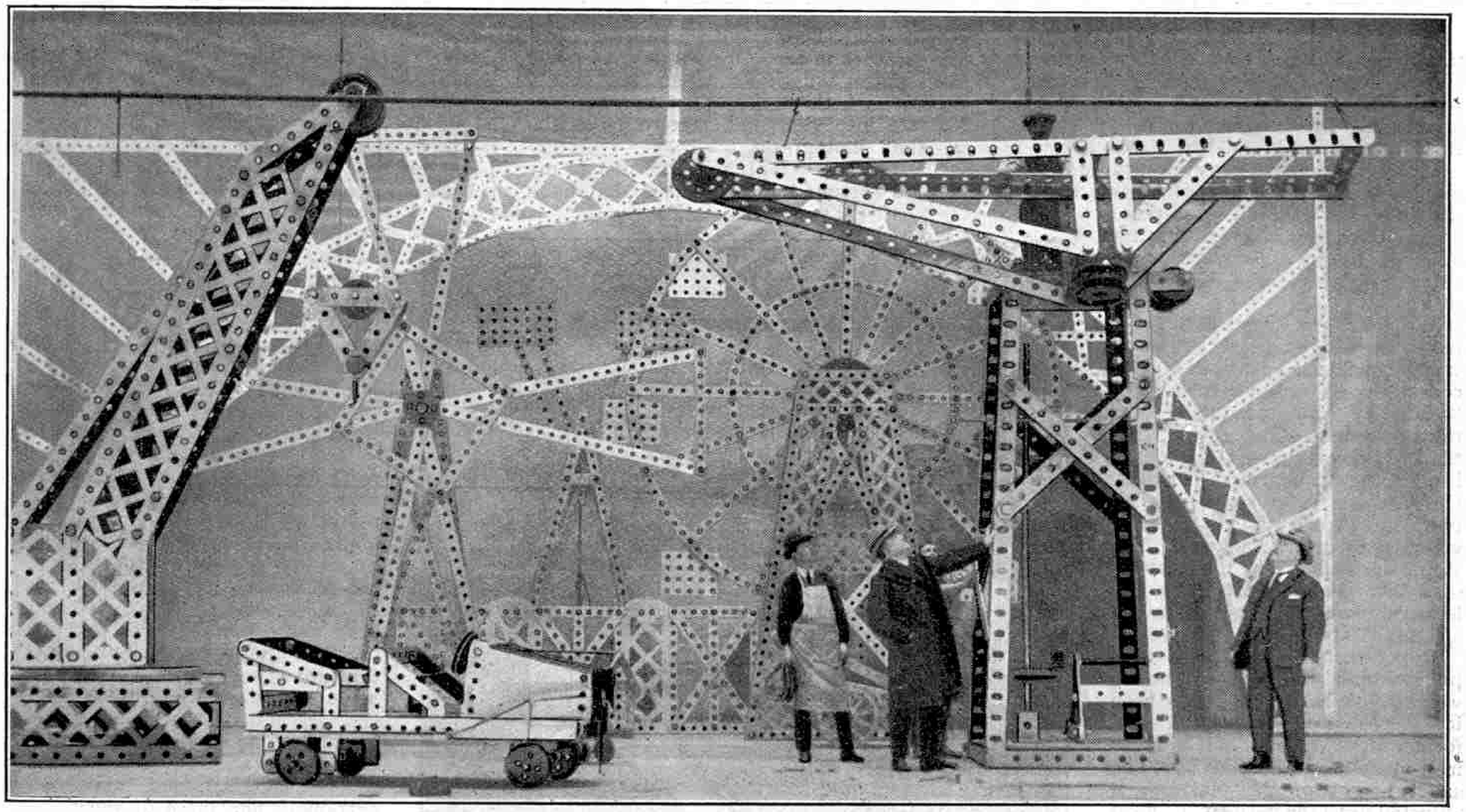
"Buttons" blushed guiltily and gazed earnestly down at his well-polished boots.

"I give in, sir," he said, "but any way—I can carry that note."

After a brief absence he returned and led me through long lines of sheet-covered seats to where Mr. Wylie was in consultation with one of the theatre officials. Greeting me in his characteristically genial manner he asked me to wait a couple of minutes until he finished giving certain instructions.

In the meantime I glanced around. The first thing that struck me was the extraordinary contrast between the stage and the auditorium—the former brilliantly illuminated and alive with a small army of busy carpenters, and the latter, dimly lighted, silent and mysterious. From time to time the figures of cleaners could be discerned, looking almost ghostlike in their blue overalls as they passed across patches of light to be swallowed up again in the shadows. The eerie appearance of the huge theatre was intensified by the fog which, after hovering over Liverpool for many days, had at last descended in earnest and taken the city in a stranglehold.

There is a peculiar atmosphere about a large theatre in the daytime. On entering from outer daylight one



The Giant Model of the Meccano Girder Crane almost completed

seems to lose all sense of time and to be entering a world where the risings and settings of the sun are of little account. My thoughts were running somewhat on these lines when two words floated across to me from where Mr. Wylie was still busily talking—

"Grave-trap!"

These had no special significance for me at the moment, but I could not help hearing that they were repeatedly uttered and, I thought, each time in a more ominous tone. In spite of the matter-of-fact presence of the stage carpenters a slight shudder passed through me. A grave is bad enough, but a "grave-trap"—!

Suddenly Mr. Wylie tapped me on the shoulder. "Come along," he said, "I want to get you settled before I do anything else."

Get me settled! Horrors! The "grave-trap!"

My one impulse was to fly, but I was held firmly by the arm and it appeared to me that all the carpenters on the stage had ceased work and were watching me furtively, ready to be after me like terriers after a rat if I attempted to escape.

On to the stage I was led, and for a moment my fears were swallowed up in a gasp of astonishment. What a size! The stage looks big as one sees it from the auditorium during a performance, but it is impossible to realise its vast dimensions without actually setting foot upon it.

My escort stepped to one side to speak to the electrician and my terrors were returning in full force when relief came from an unexpected quarter. I felt a gentle tap and on turning round beheld the jolly, good-natured face of one of the carpenters.

"Cigar's going alright sir," he said.

"What cigar?" I enquired blankly.

"Mr. Wylie's, of course. It's as good as a barometer. So long as it's going well everything is alright, but if he throws it away before it is half smoked—somebody's for it!"

I looked anxiously, and there could be no doubt that the cigar was going very well indeed. I breathed more freely!

And now my guide began to point out to me the remarkable construction of the stage. It is a veritable jig-saw puzzle. Here, there and everywhere are moveable sections giving access to the "lower regions" in which are situated the various raising and lowering mechanisms. These sections slide out upon their appointed paths with the utmost ease, and yet when they are replaced in position the whole stage is as firm to the tread as though it were solid. Mr. Wylie informed me that, when the construction of this great super-music-hall was decided upon, he was asked to design the stage so that it would be capable of any pantomime "stunt" without the necessity of alteration and adaptation as each pantomime came round. There is no doubt that he has been highly successful in this task, for it is impossible to imagine any effect for which this stage does not provide the fullest possible facilities.

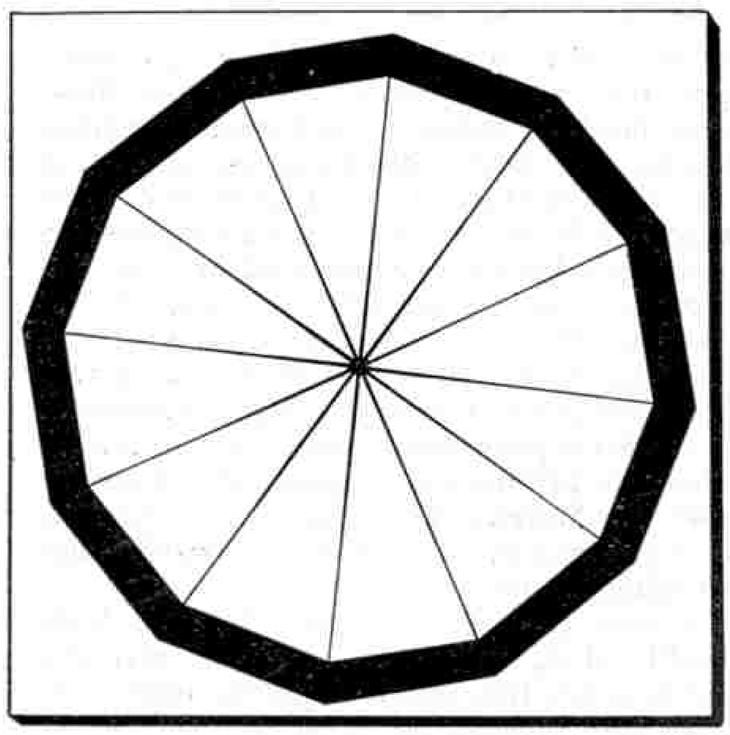


Diagram showing "Star-Trap"

I noticed that the moveable sections of the stage were of different sizes and I enquired as to the use of a small one, perhaps 30 in. square. This, I was informed, was a "star-trap," and the larger one over in the centre of the stage was a "grave-trap!"

At these ominous words my interest in the proceedings became distinctly less keen and when Mr. Wylie invited me to proceed with him to the "lower regions," to investigate the mechanism, I felt that this was the end!

Passing through a heavy fire-proof door we descended by means of a wide stone staircase. A second fire-proof door barred our way and after opening this we entered the most extraordinary place I have ever seen.

We were now immediately beneath the stage and all round us was a bewildering maze of timber construction. Here were all the "gadgets" for producing the most startling stage effects, and first of all I was shown the mechanism of the "star-trap." Briefly this consists of a small wooden platform, some 30 in. square, which rises or falls between four stout uprights after the manner of a lift. No self-respecting lift, however, would dream of behaving as this "star-trap" behaves.

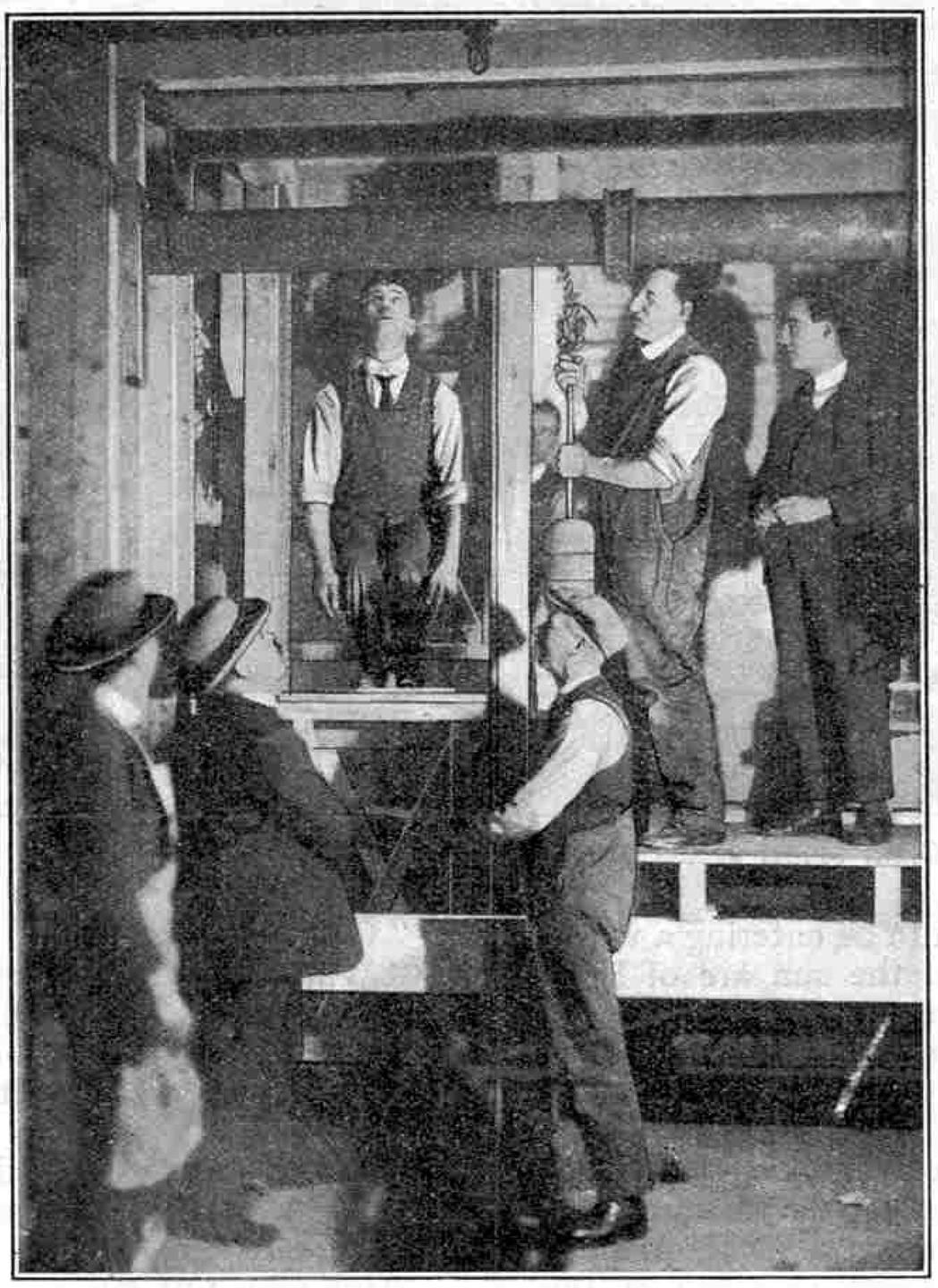
Ropes rising from it pass over pulleys and terminate in heavy weights. When it is to be used it is hauled down and a performer steps upon it, half a dozen men meanwhile standing by. The exact height of the platform is adjusted until the performer's head is just touching the centre of what is called the "star." This is a board that fits exactly the opening in the stage, and it derives its name from the fact that from its centre to a few inches from its circumference it is cut in triangular sections, as shown in the accompanying figure. The sections are hinged with leather at their broad ends, and pressure applied from below at the centre of the "star" causes the triangular pieces to rise and thus leave a clear opening. The undersides of the sections are covered with linen to prevent the possibility of splinters and the pointed ends are rounded off and padded.

When the performer's head is nicely touching the centre of the "star" the six men grasp the platform, three at each side, and at a given signal throw it upward with all their strength. The impetus thus given, added to the influence of the weights, causes the platform to rise catapult fashion and shoot the performer through the "star" to a height of some feet above stage level. The successful and effective use of this mechanism requires a considerable amount of skill, and I moved away hurriedly when it was suggested that I might like to try it for myself.

I was anxious to obtain a photograph of this "star-trap" mechanism for the benefit of readers of the "*M.M.*" and having captured my photographer we made the attempt. One of the carpenters was persuaded to pose for the purpose, but a difficulty immediately presented itself in that, when his head was in the correct position touching the "star," his face was hidden from view. The situation was awkward because, as Mr. Wylie pointed out, this was his best-looking carpenter.

For a moment or two we were nonplussed, and my suggestion that, with so many tools lying about, there should be no difficulty in sawing a length off the victim, was immediately suppressed on the ground that the carpenter was wanted for special work in London next day. Finally the victim suggested that he should "give" a little at the knees and so bring his face into view, and thus you see him in the photograph.

Turning my attention to the rest of my strange surroundings I noticed that hand winches were bolted to the floor in various positions, and I was informed that these were used for raising and lowering various similar but larger mechanisms—including the "grave-trap!" And now my fears were finally set at rest, for this proved to be a very harmless-looking affair, but one capable of producing striking stage effects. I was informed that it derived its ominous-sounding name from the fact that it was first used in the Grave Scene in "Hamlet." It is also a prominent feature in "Faust," where it provides a convenient means of lowering Marguerite to the nether regions. In pantomime, of course, its possibilities are almost unlimited.



Showing the Working of the "Star-Trap"

I was greatly impressed by the high quality of all the woodwork. Not only was the construction carried out on unusually solid and substantial lines, but the workmanship was remarkably good. The most casual glance around showed that no money or care had been spared in this department and it must have required extremely skilful planning to get so much mechanism into the available floor space.

We now returned to the stage upon which, during our absence, a transformation had been effected. All the various odds and ends had been cleared away and the stage was occupied by the enormous Meccano models that are the great feature in the wonderful Meccano scene in "The Sleeping Beauty." Behind all the models was a huge arch of Meccano, forming a brilliant silver background to the whole. In front of this were an enormous wheel, a flip-flap, and a windmill, and in front of these again two gigantic cranes. The girder crane on the right of the photograph was not yet complete and the stage hands are seen at work upon it under the direction of Mr. Wylie.

The models themselves are extremely wonderful. The two cranes and the other large models are built exactly to scale, eight times the original size, and it is very fascinating to see all the old familiar strips, girders, wheels, plates, etc. reproduced in these giant proportions. All the larger models work perfectly and the sight of them all in motion is one that is not easily forgotten. We obtain, as it were, a glimpse into another Meccanoland and see the playthings of the giants. I had the pleasure of chatting with the expert workman who planned and built these models. He told me that he found the first model difficult to make, but afterwards, when he had thoroughly grasped the Meccano scheme, he made the remaining models without any trouble at all. He is certainly to be congratulated upon an extremely fine piece of work.

Our first photograph shows the upper structure of the girder crane ready to be raised and the next shows this hoisted and being placed in position. Prominent in these and all other operations was Mr. Wylie's Stage-Carpenter-in-Chief, who apparently finds no difficulty in superintending "umpteen" different things at once. He has not yet quite solved the problem of being in two places at once and I do not think he will ever do so now, because his figure is distinctly less slender than it used to be! In spite of his natural shyness I managed to include him in the photograph and he is seen on the right of the girder crane, watching with a critical eye the final operations. I heard a whisper that he is the best stage carpenter in England, but I was sternly forbidden to give him a hint of this lest he demanded an additional £100 a week!

The Meccano scene is planned on gorgeous lines. In addition to the giant models the stage will be occupied with Meccano boys wearing the regulation jersey and a chorus wearing unique head-gear, each member's hat being crowned by a different Meccano model in miniature. The lighting effects are a great feature and the whole of the apparently inexhaustible electrical resources of the theatre will be called upon to bathe the stage in a wonderful glow—the result of bank upon bank of lamps with a total of thousands of candle power. The immense switchboard from which the lighting of the great theatre is controlled is fitted with every mechanism yet invented, and the operator in charge is able to vary his lighting effects with a rapidity that is almost startling. He may be said to play upon his switchboard as an expert pianist plays upon the keyboard, producing lights of every colour and strength, either separately or blended into the most wonderful combinations.

(*Continued on page 33*)

Raising the German Warships

Extraordinary Salvage Work at Scapa Flow

(Concluded from last month)

LAST month we described the preparation of the German Submarine Testing Dock for the task of raising the sunken German warships at Scapa Flow. We also described how the reconstructed dock was safely towed the 700 miles from the yard of Messrs. Cox and Danks Ltd., at Queenborough to Scapa Flow, and there cut into two pieces to form two pontoons.

The pontoons were moored over the destroyer V.70, one on each side of her position. Divers then went down and passed heavy chains under the hull of the destroyer. Each chain was passed over the pulley on one pontoon and over the corresponding pulley on the other pontoon. After ten lengths of chain had been passed under the ship and over the pulleys in this manner, the winches were manned by 80 men and the signal was given to haul up.

An Alarming Accident

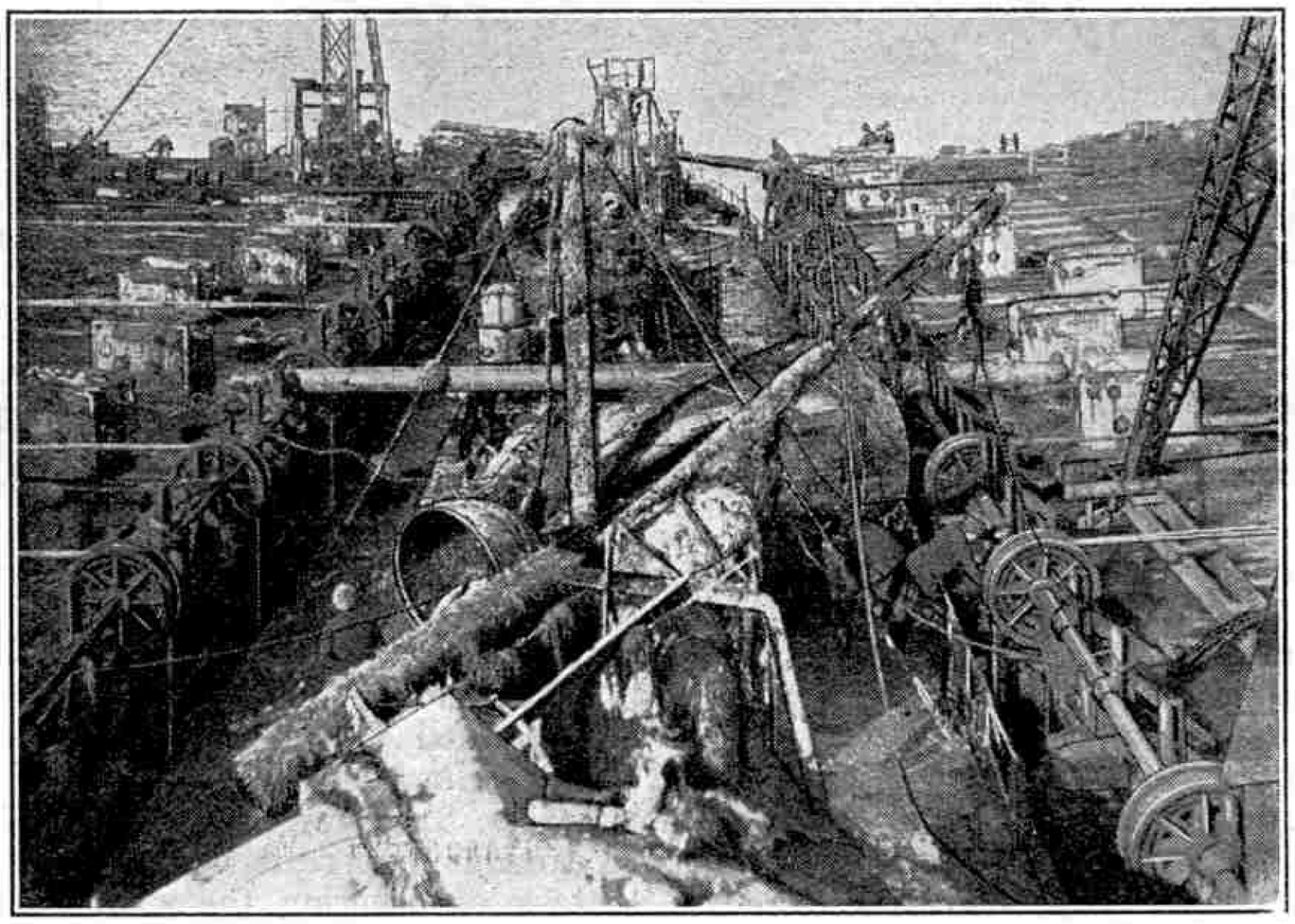
The V.70 was lifted about 8 ft. from the bottom when chain No. 10 snapped. This threw an unexpected strain on the next chain, which also gave way, and chain after chain snapped in quick succession as the abnormal load fell upon it. Huge iron links flew about the pontoons in the most alarming manner and the partly lifted wreck dropped back to the bottom. Considering the amount of iron that was flying about during this unexpected and terrifying accident, it was very remarkable that not a single man was injured in any way.

This attempt proved that the destroyer could be lifted, but also it showed that chain was not to be relied upon for the purpose. The winches and blocks had shown that they were of sufficient strength, and more notable still was the fact that three lengths of wire rope that had been used with the cable chain had stood the strain.

First Destroyer Raised

Flexible steel wire ropes 9 in. in circumference were then brought into service and passed beneath the hull of the destroyer as before, and on the night of 31st July everything was prepared for a second effort, and a condition of keen excitement and suspense prevailed among all concerned.

On the following morning the first successful lift was accomplished. At dead low tide, 4 a.m., operations were commenced by making taut the ten main lifting ropes. In this manner the rise of the tide was made use of to assist in lifting the vessel. Hauling was then started, and inch by inch, assisted by the continuous rise of the tide, the destroyer was dragged from her submarine bed.



Courtesy] [*Messrs. Cox and Danks, Ltd.*

Destroyer raised and held between floating docks

By 11 a.m. the pulleys over the main lifting ropes had been given one complete turn, which meant that the destroyer had been raised a distance of over 10 ft. in relation to the pontoons, and was then about 2 ft. below the surface of the water.

At this stage of the proceedings two tugs, "*Ferrodanks*" and "*Lyness*" belonging to the firm, took a hand in the proceedings and towed the pontoons with their prize a distance of nearly two miles into shallow water at Mill Bay on the island of Hoy. There the destroyer was safely grounded.

Rapid Progress

As will be seen from our illustration, the raised destroyer presented a most extraordinary appearance. She was festooned with seaweed and her guns were draped with pieces from 20 ft. to 30 ft. in length and 3 to 4 in. in thickness. She was absolutely overhung with marine growth, and as a war vessel she looked anything but imposing. In spite of her apparently hopeless appearance she was promptly taken in hand and set in order and she has since been used as a salvage ship in connection with lifting operations.

After the raising of the V.70, work proceeded rapidly and the lifting of the destroyers went on without a hitch. At the present time all the eighteen 750-ton destroyers have been successfully raised. Ten of these have been repaired and towed away to be broken up, four have been dismantled at Scapa and the remainder are waiting their turn to be broken up as they are not capable of repair for sea transport.

A New Dock

Work has begun also on the seven large 320 ft. destroyers the first of which has been raised. In order to facilitate work on these destroyers a new floating dock has been put into operation. With this dock the method of lifting is still the same, but whereas the lifting docks had to bring each rescued ship to the shore to be beached, in future each destroyer as it is raised will be placed in the floating dock, drydocked and repaired.

When a vessel has been raised by the lifting pontoons it will be brought into position over the submerged deck of the new dock. The five compartments of the dock will then be pumped out and the vessel thus raised.

The new dock consists of the middle section of one of the two floating dry docks of 40,000 tons lifting capacity that were surrendered by Germany under treaty. One of these docks, our readers will remember, was towed to Malta in August last along with a new British-built section to increase its length to 1,000 ft. and its lifting capacity to 60,000 tons. The other dock was acquired by Messrs. Cox and Danks Ltd., for breaking-up purposes.

We understand that the firm expects to commence the salving of the battleships "*Hindenburg*" and "*Seydlitz*" early next spring.

Salvage work is always dangerous, particularly to the divers themselves. Owing to the tremendous pressure of the water, it is impossible for a diver to go down much over 200 ft., and even then about half an hour is required to lower him and an hour or more to bring him up again, because of the difference in pressure.

In one of our future issues we intend to publish an article on deep-sea diving, its dangers and difficulties.

(*We are indebted to Messrs. Cox and Danks Ltd. for some of our illustrations, and for permission to make use of an account of the salvage operations written by Mr. G. Atkinson of this firm*).

FAMOUS BRIDGES VIII

Waterloo Bridge

Saving Rennie's Masterpiece by a Wonderful Feat of Engineering

DURING the past few months we have made several references in these columns to Waterloo Bridge which, as our readers know, has had to be closed temporarily for repairs made necessary by the subsidence of one of the stone pillars.

The repairs have been described as a wonderful piece of engineering work and the end of the first stage was reached when a 280 ft. span weighing 500 tons, to be used for a temporary bridge, was moved 93 ft. sideways from the old bridge to the four concrete caissons provided for its support.

Moving the 500-ton Span

This huge span was put together on the old stone bridge where it lay on bogies placed on rails. These rails were laid along girders that stretched 93 feet over the water. The work of moving the span was commenced by an army of 150 men at 4 o'clock in the morning. Steel hawsers working on winches pulled the span inch by inch across the gap.

Special means were provided for preventing the span from moving too quickly, and the proceedings were controlled by engineers at whose direction signals were given by means of whistles, the men up aloft responding by waving white or red flags. Steadily the enormous mass proceeded on its journey, and shortly after noon the task was accomplished, when the Union Jack was run up amid ringing cheers. It is interesting to know that the engineers found that the span had expanded $\frac{5}{8}$ of an inch between the coolness of the early morning and the heat of mid-day.

The span was not placed immediately on to the caissons but rested on rails about 10 ft. above. The task of lowering the span inch by inch into position was one of extreme difficulty, but it was accomplished on the following day without a hitch.

Thousands of Londoners gathered on the banks of the Thames to watch the operations, and Meccano boys were evidently well represented, for we have received several accounts from eye witnesses. One enthusiastic reader took a number of photographs as he thought they would be of interest to readers of the *"M.M."* who had heard of the repairs to the bridge but were unable to see the operations for themselves. "Being a Meccano boy myself," he wrote, "I can quite appreciate their wanting to know all about it." Incidentally our young photographer tells us that the film was developed at 9 o'clock the same evening, and the prints were made at 6.30 next morning so that they could be sent to us in good time.



The Centre Span lying on the Bridge, ready to be rolled into its final position



The Centre Span ready for lowering. It was raised and lowered by Hydraulic Jacks

Engineers Disagree

There has been considerable discussion in regard to the future of Waterloo Bridge. The experts of the London County Council reported that the structure was worn out and dangerous, and recommended that it be demolished. Members of various London societies, however, are anxious to preserve the bridge on account of its architectural beauty and because it is one of the masterpieces of Rennie, the great engineer. These members pleaded for reconsideration of the sentence passed by the engineers, and the L.C.C. agreed to re-open the matter if sufficiently good grounds could be advanced to justify this course.

On hearing this decision the societies went to work and they have now presented reports of other engineers, and these seriously challenge the reports of the L.C.C. experts. One of these engineers, whose report should carry weight, is Mr. C. F. Bengough, formerly Chief Engineer of the North Eastern Railway. This engineer describes, as conclusive evidence of how the bridge can be saved, the work he himself carried out in under-pinning the south pier of the High Level Bridge over the Tyne at Newcastle four years ago. The conditions there were almost identical with those at Waterloo Bridge.

Under-pinning the High Level Bridge

"The method adopted at Newcastle," says Mr. Bengough, "was first of all to construct a dam of steel sheet piling round the pier. This dam was practically watertight, a six inch pump, working intermittently, being all that was required to deal with the water. The underpinning of the pier with concrete was carried out in sections without any difficulty, the dimensions being determined by the spacing of the piles, and the original piles, which were perfectly sound, being left in."

Mr. Nicholas Geyde, another engineer who was consulted about the Newcastle Bridge, strongly supports Mr. Bengough in his view that the methods employed on the Tyne are admirably adapted to the case of Waterloo Bridge.

Will the Bridge be Saved?

These reports are of considerable interest, but it is difficult to reconcile them with the report of the L.C.C. experts, which stated most definitely that both the timber and the stonework of the bridge piers had decayed.

It will be interesting to learn what is to be the next step. Certainly the L.C.C. must give careful consideration to the new reports before finally deciding to demolish Rennie's masterpiece.

One of the most important points that will, no doubt, receive their attention, is the fact that the present bridge can be repaired for half the sum that a new bridge would cost.

History of the Bridge

The project of a bridge to connect the Strand near Somerset House with the Surrey side of the Thames at Lambeth, dates back to 1809, when a bridge company took up the matter. A plan was submitted by George Dodds, a well-known engineer of the time, but was not approved. Later, when the Act authorising the construction of the bridge had been passed, the company applied to Rennie for advice as to a suitable structure.

Rennie's first step was to make an entirely fresh chart of the river and its shores after a careful survey had been made by Francis Giles, an expert land surveyor, whom Rennie had frequently employed to carry out the hydraulic surveys for the canals and harbours under his construction. Two designs were prepared, one with seven equal arches and the other with nine, and after due consideration the nine-arch scheme was ordered to be carried out.

The Waterloo Bridge as executed consists of nine equal semi-eliptical arches each of 120 ft. span with a rise of 34 ft. 6 in. The piers are 20 ft. wide, each having projecting buttresses supported by two three-quarter Doric column pilasters after the design of the temple of Segesta in Sicily. The roadway above the piers is

(*Continued on page 52*)

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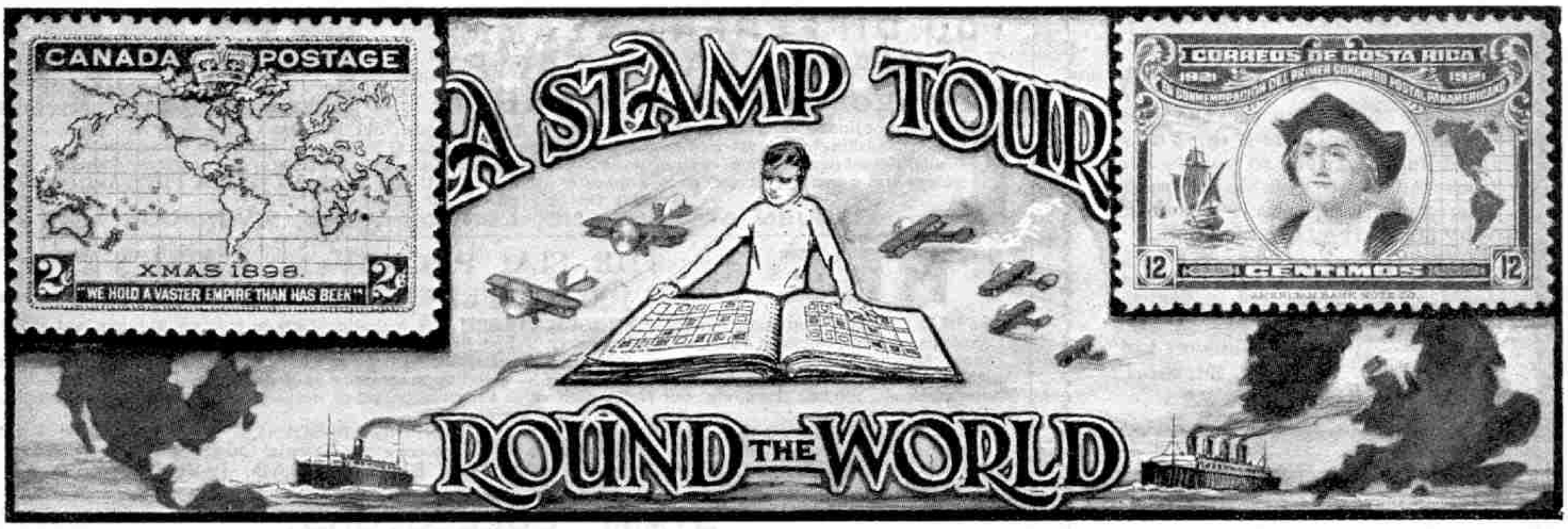
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XVI. CENTRAL EUROPE AND HOME

CONTINUING our tour of the towns of Austria, we fly due west from Vienna for about 50 miles until we arrive at Melk.

Here we find the magnificent Benedictine Abbey of Melk built on the top of a high portion of one bank of the river Danube, which flows through this town. There are many fine buildings on the banks of the Danube, but this monastery together with the ruins of Dürrenstein, where Richard Cœur de Lion was held prisoner, are the most interesting. The monastery at Melk was pictured on the 600 kronen value of the 1923 series of stamps and is illustrated here.

From Melk we continue westwards following the course of the Danube for a further 50 miles until we come to Linz (240 kronen, illustrated), the capital of Upper Austria. It has a population of roughly 60,000 and possesses two cathedrals, a castle, an excellent museum and several other important buildings. It is connected to Urfahr on the opposite bank of the Danube by an iron bridge 308 yards in length.

The view shown on the stamp is, we believe, of the Franz Josef-Platz in which may be seen a marble column, almost as high as the surrounding buildings. This was erected in 1723 by the Emperor Charles VI. to commemorate the deliverance of Linz from war, fire and pestilence. On account of its three-fold object it is known as the Trinity Column.



The Parliament Buildings, Budapest

With our visit to Linz we have completed our tour of Austria and we now return eastwards and continue for about 250 miles to Budapest, the capital of Hungary, which is, as all Meccano stamp-collectors are well aware, now entirely distinct from Austria. At Budapest we are mainly concerned with the Parliament Buildings, which were pictured on the higher values of various issues between 1916 and 1923 (illustrated here).

These huge limestone buildings cover an area of $3\frac{3}{4}$ acres and are situated on the left bank of the Danube, which flows through the centre of the town. They are the work of Steindl and their plan is based upon that of the Houses of Parliament, Westminster, there being a central hall with the Chamber of Deputies on the left-hand side, and the House of Lords on the right. The arrangement of the seats in the two chambers is different, however, from the arrangement at Westminster. While ours are arranged in two groups facing one another, one side for the Government and the other for the Opposition, the Budapest building has its seats arranged in semi-circular rows as is the custom in many European houses of government. Our system is ideal for two political parties, but the semi-circular style is probably better when there are several important parties, as is the case here.



The Land of the Poles

From Budapest we turn northwards, leaving Hungary and making Cracow, Poland, our next calling place. Cracow is a very important trading town and has a population of over 150,000. It has very many old historic buildings containing priceless relics of the story of Poland, for no town of this country has been more concerned with its destinies than has Cracow.

Situated in the south-west part of the town on a rocky eminence known as the Wawel, is the Castle of Wawel, pictured on the 15 gr. value of the 1925 issue of Poland and illustrated here. This royal castle was begun in the 13th century and was afterwards enlarged by both Casimir the Great and Sigismund I. Jagiello so that to-day it is a huge building. It has had a varied history and has suffered from several fires in its time, but it is now restored to its former condition.

Continuing northwards, we next visit Warsaw, the capital. Warsaw is a very interesting city and contains a large number of palaces, cathedrals and public buildings. It is one of the most important as well as one of the pleasantest cities of eastern Europe, being beautifully situated on the right bank of the Vistula, across which is the Alexander bridge built in 1865 at a cost of over £600,000. This bridge is 1,666 ft. in length.



At Warsaw is the Sigismund III. monument (Poland 1925, 3 and 10 gr., illustrated) in Sigismund Square where the old and interesting royal castle, the Zamek Krolewski, is also to be found.



From Posen to Denmark

From Warsaw we turn northwards to Posen, before the war a city and fortress of Germany but now a part of Poland. Here we pay a visit to the quaint old Town Hall (1925, 5 gr.) with an architecture that is a Slavonic adaptation of Romanesque forms. Posen is situated in the midst of a net-work of railways that connect it with all parts of Germany and Poland. It manufactures machinery, furniture and sugar, as well as carrying on an extensive trade in various other articles, and before the war had a large export trade.

From Posen we fly north-eastwards until after about 400 miles we reach Vilna, situated at the junction of the railways from Leningrad to Warsaw and from Libau (on the Baltic) to the mouth of the river Don, on the sea of Azov.

Here we visit several buildings that have been pictured during the last six years on the stamps of Central Lithuania. First there is the Cathedral of St. Stanislaus of which a general view is shown on the 2m. of 1921 illustrated here, and a near



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view of the building and the adjoining tower on the 4m. of 1920. This cathedral was erected in 1387 and restored in 1801 and is a very fine building.

The 1m. of the 1921 series (illustrated) shows St. Nicholas' Cathedral built in 1596-1604. Unlike the former cathedral this possesses towers and spires and is more like the type of cathedral we are used to in England. The 2m. of 1920 shows the Ostra Brama chapel, noted for containing a greatly venerated image of the Virgin.

From Vilna we turn westwards, flying over Konigsberg, near Dantzig, and over the Baltic Sea towards Denmark. On our way, however, we call at Marlenburg a few miles S.E. of Dantzig. The castle was shown on the 3 mark value of a 1924 issue of Germany. It was founded in 1274 and was of great importance during the middle ages. On the choir of the church of this castle is a huge figure of the Virgin in hard stucco decorated with glass mosaics.



The Castles of Denmark

Our first call in Denmark is at Elsinore, a seaport on the east coast of the island of Zealand at the narrowest point of the Sound, opposite Sweden. It is not with the town of Elsinore that we are concerned, however, but with the Castle of Kronberg (Denmark, 1920, 10 ore), a Gothic building on a tongue of land eastwards of the town itself. This magnificent structure was originally built in the 16th century by Frederick III. but it had to be restored by Christian IV. in 1637 as a result of a disastrous fire. One of its turrets serves as a lighthouse to guide ships through the Sound, which is only three miles in breadth at this point.

From Elsinore we fly a few miles S.W. and visit Roskilde Castle (1920, 40 ore). Roskilde was at one time the capital of Denmark and is now an important railway junction. Its cathedral is to the Dane what Westminster Abbey is to the Briton, for in it lie buried most of the Danish kings from the year 987.



From Roskilde we continue westwards to Sonderburg (1920, 20 ore), a seaside resort of Schleswig-Holstein, now a part of Denmark. The castle pictured on the stamp has a beautiful chapel in which many important people have been buried.



Wartburg Castle and Cologne Cathedral

We now return to Germany by paying a visit to the Wartburg Castle, situated near Eisenach, which is about 100 miles south of Hanover. The Wartburg was pictured on a 5,000 marks stamp of 1923 and is illustrated here. It was founded by Louis "the Springer" who died in 1123, and is famous for its many historical associations. In 1207 the minstrels' contest that is still remembered in Wagner's *Tannhäuser* took place here and shortly afterwards Elizabeth of Hungary took up residence within its walls. Here too Luther was brought for safety in May 1521 and while here he completed his translation of the New Testament.

Resuming our westward course we next visit Cologne Cathedral which was pictured on the 10,000 marks stamps issued at the same time as the Wartburg stamp and illustrated here. The Cathedral is the principal object of interest at Cologne and is a very fine example of Gothic architecture. There have been three cathedrals on this site, the first being erected about 825. The present building was begun in 1248 but the work progressed very slowly and even ceased entirely at one time. In consequence it was not finally completed until 1880 when it was opened by the Emperor William I. The plan of the edifice is in the form of a cross 480 ft. in length and 282 ft. in breadth, and the two towers shown on the stamp are 511 ft. in height.

The Grand Duchy of Luxemburg

From Cologne we continue westwards to Luxemburg to pay a visit to the ancient town of Vianden. The ruined castle on a rocky eminence in this town was pictured on the 1fr. value of the 1921 issue and is illustrated here. This castle dates to very ancient times and now stands in ruins except for the chapel, which was restored by Prince Henry of the Netherlands in the middle of the last century. The Knights' Hall had accommodation for five hundred men-at-arms when the castle was in regular use and from this the size of the whole building may be gauged.

Back to the Land of Meccano

Our tour is now complete and we turn our aeroplanes towards Liverpool and home, where extensive preparations have been made for our reception. Since there is no suitable landing ground in Liverpool for so large a fleet of aeroplanes as ours, we first touch England again on the extensive, smooth and firm sands of Southport, the prosperous residential and holiday town twenty miles north of Liverpool. Here we find a fleet of motor-cars waiting our arrival and amidst great excitement we set off in a cheering procession to Liverpool and the Meccano Works.

Arrived there we find Mr. Frank Hornby, the Editor of the "*M.M.*," and the heads of the various departments waiting to welcome us and to entertain us to lunch. What a merry meal that was! What chattering! All of us full of excitement to be back again! What cries of delight there were when we saw a huge map of the world along one side of the dining hall, showing all the countries we have visited during our tour; we have entered every continent, visited nearly seventy countries and seen the principal sights of the world.

Beginning at Liverpool we crossed the Atlantic and visited the oldest British colony, the forest-covered island of Newfoundland. From there we went to Canada and inspected the scene of the famous battle between Montcalm and Wolfe, continued to the Niagara Falls and, after visiting several other places in the United States, left by way of New York. In rapid succession we then visited Bermuda, Hayti, and other islands of the West Indies, together with British Guiana.



The engineering wonders of the Panama Canal aroused our keenest interest and we left them reluctantly to pass on to the other countries of Central America and South America. Leaving this continent at Valparaiso we visited several islands in the Pacific, and Japan and Formosa. The East Indies, New Zealand, Australia and Tasmania next claimed our attention and then we proceeded to South Africa. Calling at the French island of Reunion on the way, we arrived at Zanzibar and then flew down the coast to Beira, inland to the Victoria Falls, and southward to Cape Town, whence our ship took us up the west coast. We flew inland up the Congo and then sailed westward to St. Helena and northward to Morocco, which we toured by aeroplane.

The Mediterranean coast was the next on our list, Tunisia, Egypt (with a call at Eritrea, Djibouti and Iraq), Syria, Grand Lebanon and Turkey being visited in turn. Finally we flew inland over Europe, the countries visited being Bulgaria, Montenegro, Bosnia and Herzegovina, Italy, Switzerland, Austria, Hungary, Poland, Denmark, Germany and Luxemburg.

A tour round the Meccano Works completes our visit and then we all make our way to our respective towns and homes scattered throughout the country, eager to tell our friends and relations of all our experiences.

Forthcoming Stamp Features

Our stamp page programme for 1926 includes a number of unique features of outstanding interest. Next month our main article will be devoted to a description of interesting stamps recently issued. The March and April articles will deal with stamps illustrating the great men who may be regarded as makers of the United States. Subsequently articles will deal with the "Coming of the First Postage Stamp," "Pioneers of the British Empire," "The Cause of the World War," etc.

Sharp-eyed readers will be specially interested in an article to appear in the June issue dealing with stamps that are nearly, but not quite, alike.

STAMP ADVERTISEMENTS

Foreign Stamps on Approval, all ½d. each, suit beginners.—J. Gleave, Market Hall, Inverness.

100 Different Stamps Free. Send for ½d. approvals.—Cox, 135, Cambridge Road, Seven Kings.

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PHIL, 20, Castle Street, Dover.

BRITISH COLONIAL STAMPS on approval, ½ Gibbons, good copies. Collections purchased.—Barlow, 8, Sidwood Road, Brighton.

100 Different British Colonials, 1/- ; Foreign, 200, 9d. ; 100 Unused, 6d. ; Mixed, 500, 1/-. Postage extra. Approvals on request.—Croft, Adel, Leeds.

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STAMP COLLECTORS in England and Colonies should join Philatelists' Exchange Club to buy and sell stamps, also exchange with 900 members in 100 different countries. Subscriptions 5/-. Full particulars from M. Bland, Mansfield Road, Parkstone, Dorset.

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The Story of Metals—(*cont. from page* 16)

away for the time being and it was not until some 60 years later that a tin-plate works was established at Pontypool in Monmouthshire. From that small beginning has developed the enormous tin-plate industry of South Wales.

Tin readily forms an alloy with most metals and its use for this purpose is very extensive. With lead it forms pewter and various solders and it has a marked hardening effect on copper. Gun metal, which has great strength, contains from 8 to 10 per cent. of tin, and the copper used for coinage purposes contains about 5 per cent. tin. The uses of tin foil are too well known to require mention.

(We are indebted for our illustrations and much of our information to the Malay States Information Agency).

Giant Meccano Models—(*con. from page* 24)

This scene alone is worth a long journey to see, and I can assure all Meccano boys that they will find it wonderfully fascinating. This is not all, however, for "The Sleeping Beauty" is a masterly piece of work from start to finish.

The time at my disposal came to an end all too soon and I was reluctantly obliged to tear myself away. As I shook hands with Mr. Wylie and thanked him for his courtesy, I told him that, for the first time in my life, I realised that a pantomime was not merely an affair of costumes, songs and dances, but was in fact a great feat in engineering.

Photography—(*continued from page* 58)

A young friend of mine recently made quite a small fortune by selling to his friends quaint photographs of themselves. The prints depicted stout people with thin and slender bodies, thin people with bodies twisted to represent springs, and every possible variety of long heads, fat heads, etc. His photographs sold like hot cakes and caused quite a local sensation until he was discovered one evening holding freshly-developed negatives in front of the fire and pulling and pushing the gelatine to make the images assume the desired shape. I give two hints for the benefit of any Meccano boys who feel inclined to attempt this scheme. First, make sure that your victims really possess a sense of humour, and second, don't make the gelatine hot or you will be surprised how fast it can run!

Next month we shall give some further examples of trick photography, one of which will show how to photograph a man with his head cut off, and held in his hands!

A Fortune in Stamps!

At a very interesting sale of stamps, recently held in London, the sum of £5,359 was realised for a collection with a romantic history. The stamps were bought 60 years ago, stored away in an attic in Mayfair and forgotten. They were recently discovered, still lying in the attic, and the owner decided to have them valued and to sell them, with the result already mentioned.

It appears that the original collector, a young man, used to send money orders to various postmasters in the colonies, asking for specimen stamps to be sent him in return. In this way he spent about £20, which sum has appreciated by nearly 270 times in the course of 60 years!

The sale aroused great interest in philatelic circles, since there was an amazing array of rare and beautiful specimens. A complete sheet of 240 British Columbia 2½d. stamps realised £750. A complete sheet of Ceylon ½d. Lilac, 1858 (which cost the original buyer only 10/–) realised £650. A similar sheet, but with two stamps missing brought £530. A sheet of 222 Queensland 1862 penny stamps brought £450, whilst another interesting item was a block of 106 2d. blue Queensland which realised £325.

Three Interesting Recent Stamps

PARAGUAY
Map Stamp

In the latter part of 1924 the first stamp of the new series ordered in 1922 was on sale at the post offices in Asuncion, the capital of Paraguay. The design shows a map of the country with the rivers very prominently marked and the boundary between Bolivia and Paraguay omitted. Shortly afterwards 2 and 4 pesos appeared in the same type and the 1 peso was overprinted with a small "c" for sale at post offices outside Asunsion. The stamps are lithographed and perforated 11½. Many of the holes are not punched cleanly, however, and the paper appears to be poor as it tears with very rough edges. These stamps are believed to be the first of a complete series and consequently additional values are expected.



HOLLAND
Lifeboat Centenary

Two very striking stamps were issued by Holland to commemorate the Lifeboat Centenary in 1924. The 2c. value, printed in brown, shows a storm at sea with two masts and sails of a vessel apparently sinking under the waves. The 10c. shows the end view of a lifeboat and is issued printed in chestnut on straw coloured paper. The design of the stamps has been the subject of some discussion, for not everyone favours this style of drawing.



COSTA RICA
The Smallest Stamp?

On 3rd May, 1924, Costa Rica issued what is probably the smallest stamp of recent years. It shows a portrait of Don Rodrigo Arias Maldonado y Velasco on the left and the words "Costa Rica" and the value in numeral and words in white on a solid ground on the right. The whole is a very pleasing stamp, the engraving, the work of Messrs. Waterlow and Sons, being exceedingly fine.



The stamp was designed by Señor T. S. Guell and printed by the engravers. It was issued perforated 14 between the stamps.



In this column the Editor replies to letters from his readers, from whom he is always pleased to hear. He receives hundreds of letters each day, but only those that deal with matters of general interest can be dealt with here.

Correspondents will help the Editor if they will write neatly in ink and on one side of the paper only.

R. A. Annum (Nsawam).—"The '*M.M.*' has increased my knowledge more than all the other papers I have read from my infancy. It makes life worth living." This is a very nice thing to say to us. You may be sure that we will try to keep the "*M.M.*" up to the high standard you have set for us.

V. Gerus (Leningrad).—We were very glad to have your letter and to have an account of your interesting experiences in Russia. You seem quite happy there and no doubt you are enjoying your tour. We look forward to receiving your next letter.

J. Sharples (Darwen).—We welcome criticism, and yours is certainly of a very frank order. At all events we are glad to see that there is so much you like and so little you dislike in the "*M.M.*" Curiously enough, the articles of which you do not approve have found great favour in the eyes of large numbers of our readers. We have replied to your railway queries by separate post.

Mr. W. R. S. Smart (London).—It is always a pleasure to receive commendation from one who has had so much experience as yourself and we much appreciate your kindly interest in our endeavours to brighten the lives of Meccano boys. By the way, may we suggest that some of your experiences in model railway building might be of interest to our readers, and we shall be happy to consider any notes you may send us along these lines.

M. Cavallini (Rome).—We have many readers in Rome, but we think you are one of our most regular correspondents from that city. You should certainly join the Meccano Guild and take full advantage of the Guild Correspondence Club.

N. D. Carter (Corsham).—Your suggestion is a very thoughtful and kindly one, but our fear is that to ask for subscriptions to Orphan Homes through these columns would be a little out of place. However, you may be sure we will give your suggestion full consideration.

H. A. Trump (Bristol).—We appreciate your friendly criticisms of the Hornby Trains. We quite agree that one or two of the points you bring out were weaknesses in the earlier models, but these have all been remedied and we strongly advise you to make a point of examining the models that are now coming from the Meccano factories. Many thanks for your congratulations on the improvement in the "*M.M.*"

H. V. Reynolds (Georgetown, B.G.)—It is one of our greatest pleasures to know that boys like yourself, who live so far away from us, derive so much enjoyment from the "*M.M.*" and the Guild and the Correspondence Club. We congratulate you on winning so many prizes in our Competitions. We too, hope that some day you will be able to come to Liverpool and see us. We are interested to hear that your hobby is bee-keeping. We have kept bees ourselves for many years and find them most fascinating. We are always interested in your doings, so write to us regularly.

M. R. Pocock (Pinnaroo, S. Australia).—We are glad to learn that you have found our Correspondence Club such a help. There should be no difficulty in finding a suitable correspondent for your brother Jack who is interested in stamps. We shall watch the progress of your newly formed Meccano Club very closely and we wish it every success.

E. J. Flitcroft (Whitefield).—You are quite right, Edgar, we receive many hundreds of letters every day from boys and none of them bore us. Your own letter is so full of good things that we read it twice over! The "*M.M.*" will not be published oftener just yet, but it will certainly grow bigger.

S. Lucas (Catford).—You are evidently a great railway enthusiast and we admire the systematic way in which you have obtained all your information. Your collection of 3,500 types is a great achievement. The Railway Publishing Co. Ltd., of 33, Toothill Street, Westminster, London, will probably be able to supply you with all the illustrations you require.

N. Lolley (Bedford).—So you think Liverpool must be "an awfully nice place to live in!" I should hate to disillusion you on the subject. You have evidently been enjoying the gruesome pastime of devising methods of execution in Meccano. The hanging machine sounds distinctly alluring, but the guillotine still holds first place in our affections for a sudden and speedy end!

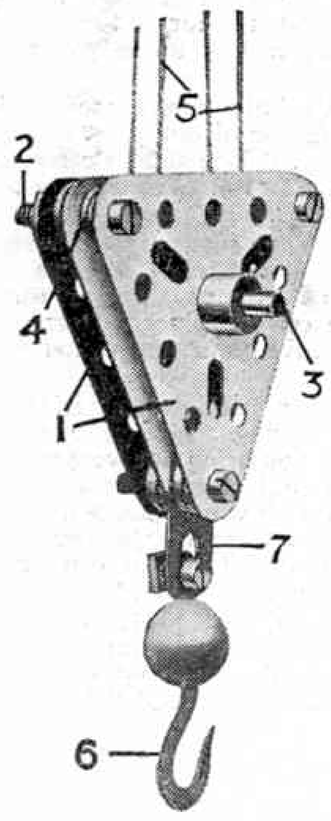
MECCANO STANDARD MECHANISMS

Section III. PULLEYS AND PULLEY BLOCKS (*contd.*)

This article is the third of a series describing Meccano Model-building practice. Last month, the principle of the Pulley was explained in detail and demonstrated by simpl Meccano experiments. The following article deals with the general application of pulleys in Meccano models, and describes how some ingenious movements may be obtained with their aid.

STANDARD Mechanism No. 32 illustrates a pulley block having two sheaves, or grooves, round which the hoisting rope may be passed. The principle of the two-sheaved pulley block was described fully in Example 3 (page 637, December "*M.M.*"), and it will be remembered that a fourfold increase in power was shown to be obtainable from such an arrangement of pulleys.

The block is constructed from three 2½" Triangular Plates (1) held together by ¾ in. Bolts (2). Two 1 in. loose Pulleys, forming the "sheaves," are pivoted on the axle (3), which is journalled through the centre holes of the Plates and fitted with Collars on each end. Four Washers (4) are placed on the bolts (2) between the Plates (1) in order to ensure clearance for the Pulleys, round which the winding cord (5) passes. The Hook (6) is carried from the lower bolt by means of the Flat Bracket (7).



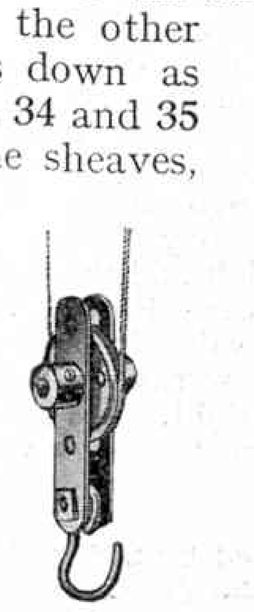
S.M. 32

The usual arrangement of the hoisting cord (5) is as follows: one end is tied to the "tail" of the fixed pulley block (secured to the model from which the block 1 is suspended), and the cord is led down to the moveable pulley block (1) and round one of its sheaves. Then it passes upwards and round one of the sheaves in the fixed pulley block, down to the second "moveable" sheave, and up again to the second "fixed" sheave. On passing over the latter, that portion of the cord forms the "running-end," by which the pulley block (1) is raised.

Single Moveable Pulleys

Three types of Meccano single pulley tackle are illustrated in S.M. Nos. 33, 34 and 35. In each case one end of the cord is secured to the tail of the "fixed," or standing block, and the other end is rove through its pulley and leads down as the running or hauling-end. In S.M. Nos. 34 and 35 the shank of a bolt forms a journal for the sheaves, which consist in both cases of ½ in. loose Pulleys. It will be noticed also that the Strips in S. M.34, and the Flat Trunnions in S.M. 35, are held at a proper distance apart by means of Washers placed on the shanks of the combining bolts.

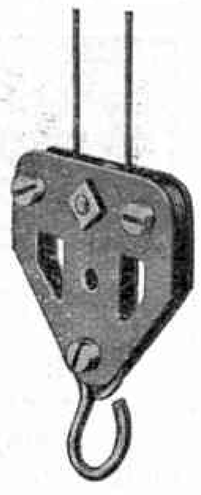
In each of these three arrangements the mechanical advantage is two, that is to say, a 100 lb. weight should be lifted (theoretically) with a force of 50 lb., for the pulley blocks would move at a speed only half as great as that at which the hoisting cord moves. (See Example 2, page 636, December "*M.M.*")



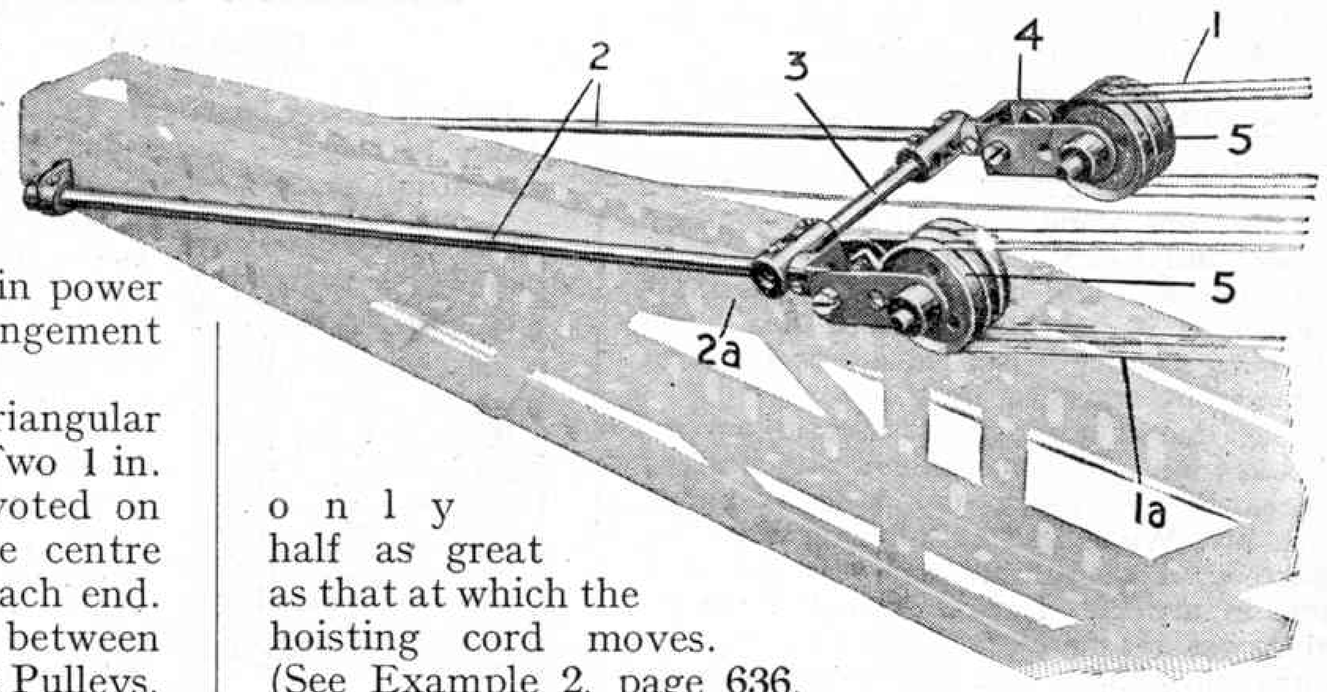
S.M. 33



S.M. 34

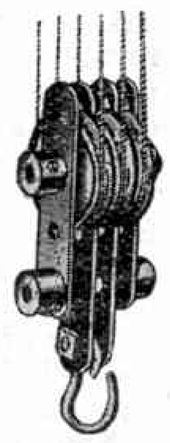


S.M. 35



Pulley Blocks in Jib-head S.M. 37

From this illustration (S.M. 37) it will be seen that the pulley blocks (4) are bolted to the tie-rods (2) by means of Fork Pieces. The tie rods are pivotly attached to the head of the jib (2A), the method of connection consisting of two Collars mounted on each tie-rod and secured one on either side of an Angle Bracket pivotly carried from the end of the jib. A strut (3) constructed from a short Rod mounted between Couplings, holds the tie-rods in position.



S.M. 36

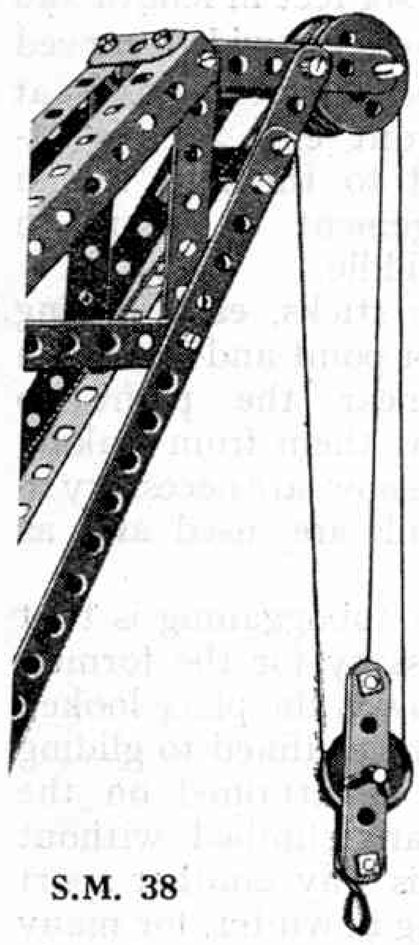
Each pulley block contains three sheaves (5). Two separate hoisting cords (1 and 1A) are employed, the running ends of each being secured to the winding-drum in the model. Each cord is led from the winding drum over a sheave in its respective fixed pulley block secured to the model. Thence it passes round one of the sheaves (5) of the corresponding moveable pulley block, then round the second "fixed" sheave, back to the second "moveable" sheave, then over the third "fixed" sheave, and back once more to the moveable pulley block, where it passes round the third sheave. The end of the cord is then secured to the "tail" of the fixed pulley block.

The operation of the cords (1, 1A) is similar to that shown in S.M. 31 (page 637, December "*M.M.*") Although the jib is supported by twelve lengths of cord instead of six, the mechanical advantage also is the same as in that example. This is explained by the fact that the running ends of the two continuous cords employed are hauled in together, therefore raising the jib at a similar speed to that obtained if only one continuous cord is used, as in S.M. 31. By duplicating the mechanism

it is possible to use increased power and consequently raise greater loads with safety. S.M. 37 reproduces a portion of the Meccano Dragline, but the mechanism described above may be employed wherever it is necessary to raise an exceptionally heavy load.

Three-Sheave Pulley Block

S.M. 36 illustrates another type of pulley block having the same mechanical advantage as those shown in S.M. Nos. 31 and 37, and suitable for the larger types of cranes. It is constructed from two 2 in. and two $2\frac{1}{2}$ in. Strips held together by short Rods and Collars with Set-screws. Four Washers should be placed on the lower Axle Rod between each pair of Strips, in order to obtain sufficient clearance for the rotating sheaves. The Hook is suspended from a bolt passed through the end holes of the centre $2\frac{1}{2}$ in. Strips. The arrangement of the hoisting cord for this pulley block is similar to that already described (S.M. Nos. 31 and 37).



S.M. 38

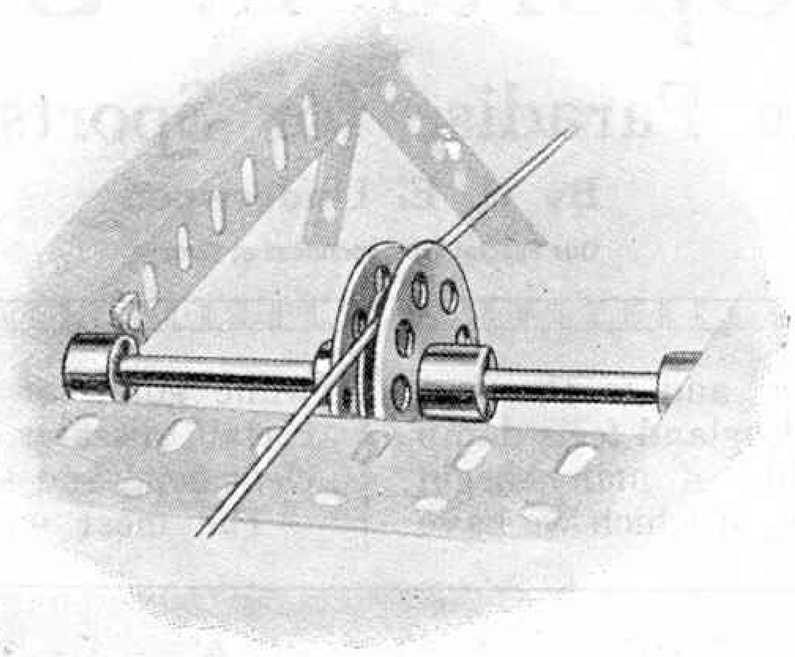
Single-Sheave Pulley Block

The hoisting-cord shown in S.M. 38, is led over one of the pulleys in the jib-head, around the sheave of a moveable pulley block, over a second jib pulley, and back again to the moveable pulley block, where it is secured. In this way, although only one moveable sheave is employed, a theoretical mechanical advantage of three is obtained, for the moveable pulley is supported by three cords, and the running end of the hoisting-cord must therefore move through a distance three times as great as that traversed by the pulley block.

Guide Pulleys

The deep-grooved pulley shown in S.M. 39 is a marked improvement over the ordinary Meccano pulley when used for the purpose of guiding travelling ropes, hoisting cords, etc. It is constructed by clamping a 1 in. loose Pulley Wheel between two Bush Wheels. If desired, sufficient "play" may be left to enable the 1 in. Pulley to revolve freely on the shaft, while the latter, together with the Bush Wheels, remain stationary. With such a pulley, there is little fear of the cord escaping from its groove, even when it is used in models in which the cord is subjected to uneven jerks and strains.

A larger deep-grooved pulley may be constructed from a Wheel Flange and two Face Plates. The Wheel Flange is bolted to one Face Plate, while the other, mounted on the same shaft as the first, is secured with its surface flush against the protruding edges of the Wheel Flange. With this arrangement the cord is led round the periphery of the Wheel Flange and is held in place by the protruding edges of the two Face Plates. If desired, the whole unit may be secured more rigidly by passing $\frac{1}{2}$ in. Bolts completely through both Face Plates, and securing with nuts on their ends. (S.M. 39A).



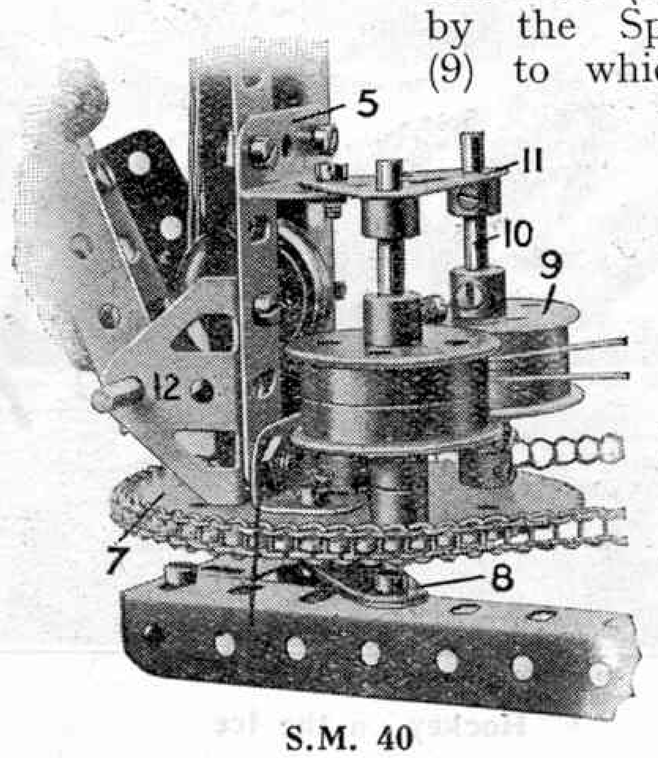
S.M. 39

This type of pulley will be found very suitable for such models as large Cranes, Derricks, Pit-head Gear, Lift mechanisms, etc.

Rope-Guides on Rotating Models

Hoisting-cords, etc., may be connected and retained in line with a swivelling portion of a model by means of the device shown in S.M. 40. The illustration represents the rotating base of the jib and upright column of the Stiff-Leg Derrick. The guide pulleys (9), constructed by butting two Flanged Wheels together, are mounted on shafts (10) journalled in a Corner Bracket (11) and in two holes of a 3 in. Sprocket Wheel (7).

As the column (5) swings about its pivot (8) the cords, one of which raises or lowers the hoisting-block, while the other operates the jib-arm, are retained in line with the 1 in. Pulleys shown by one or other of the guides (9).

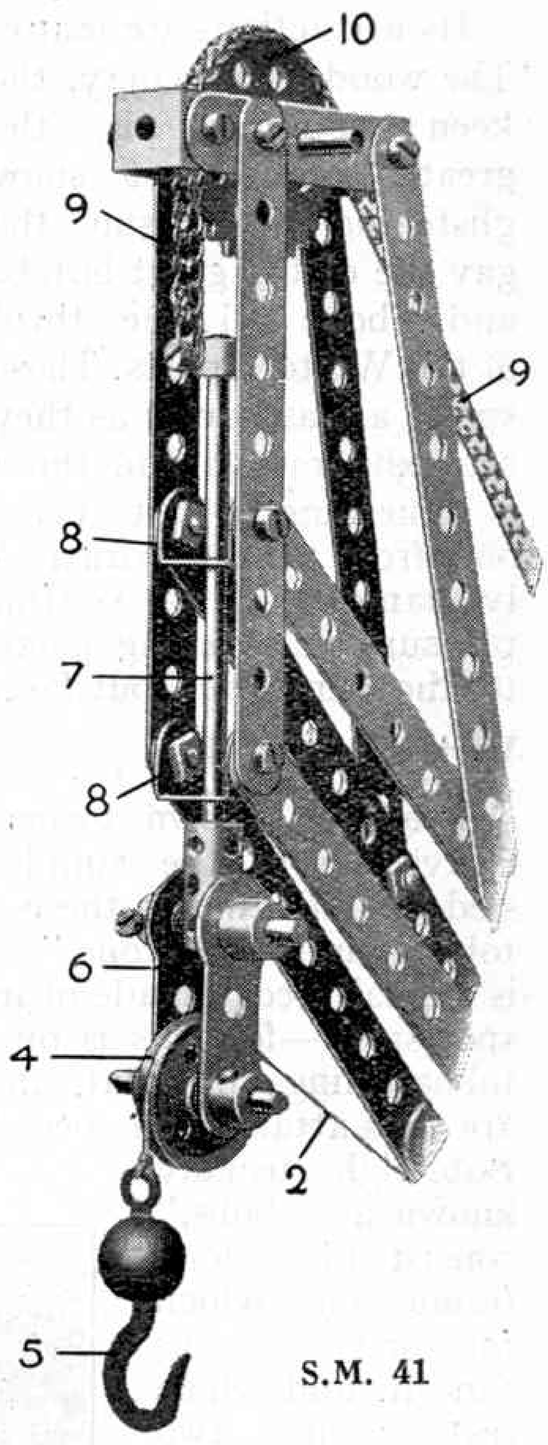


S.M. 40

Variable Pulley-Block

S.M. 41 illustrates a simple but ingenious mechanism which automatically registers the weight of a load bearing upon a pulley.

A 1 in. Pulley (4) from which a load hook (5) is suspended, is carried in two Cranks (6) connected to a $3\frac{1}{2}$ in. Rod (7) slideable in two Double Brackets (8). The Rod (7) is supported by the Sprocket Chain (9) to which it is connected by a Collar and Set-screw.



S.M. 41

By attaching the other end of the chain to some resistance, such as a Meccano Spring, the weight of a load on the Hook (5) may be calculated by noting the distance through which the Chain is pulled. The movement of the Chain may be employed to operate a pointer with graduated dial similar to that provided in Model No. 627, Automatic Weighing Crane. In this model, immediately the hoisting mechanism is brought into operation, the pointer swings round and indicates the extent of the load suspended from the crane hook.

Winter Sports in Switzerland

A Veritable Paradise for Sports-loving Boys

By H. E. Underwood

(Our Special Correspondent at Geneva)

TOWARDS the end of December, and in the first days of the New Year, when England feels damp and disagreeable, the thoughts of many begin to turn towards that distant paradise, of which we have heard so much and to which tourists go by thousands from all over Europe—Switzerland, the land of snow.

Its attractions are many. The wonderful scenery, the keen mountain air, the great expanses of snow glistening in the sun, the gay life of the great hotels, and above all the thrill of the Winter Sports. These sports are as varied as they are exhilarating, and there is something to suit everyone, from the comparatively tame and uneventful pleasure of a tailing party to the dangerous but fascinating "Ski-kjoring."

Variety of Sports

The best known forms of winter sports are those derived from the simple and primitive "luge," or sledge, and among these may be mentioned races on toboggans, "skeletons" and bob-sleighs. A skeleton is a small sledge made of iron, on which the experienced sportsman—for this is one of the most risky forms of tobogganing—lies flat, head first. Very high speeds are thus attained on special tracks, as we shall see later. Bobsleighs, usually known as "bobs," consist of a long frame on which four or six persons can sit, and which rests on two smaller frames, in shape like two small sledges. The front one can move slightly to right or left, and is controlled by a steering-wheel; the other is fixed. Long experience is needed to be the conductor of a "bob," for the slightest false move on the run, while going at the speed of an express train, means certain disaster. In this, as in other winter sports, a clear head and sound nerves are essential!



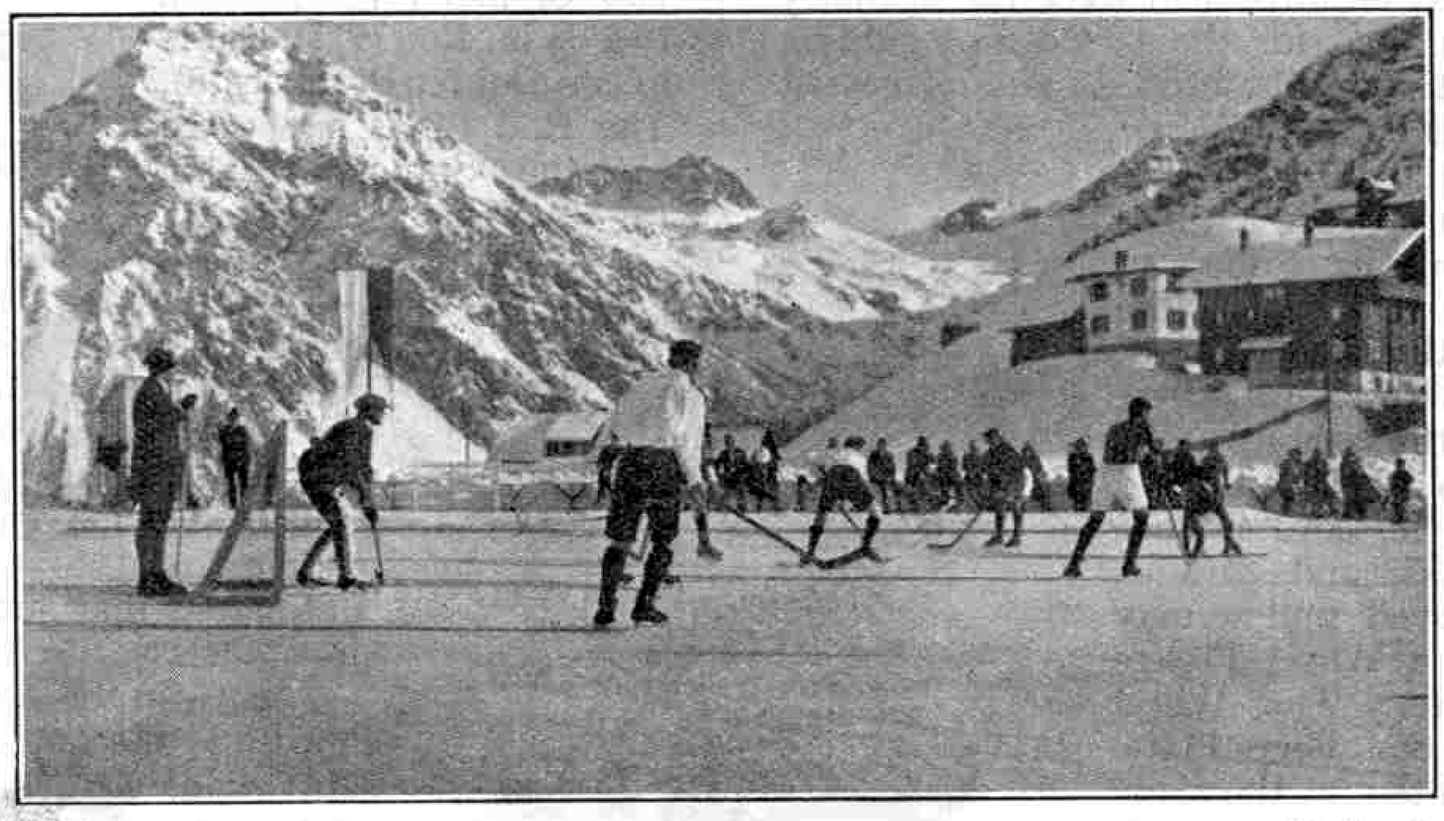
Photo] [*L. Butner*

A Typical Swiss Ice-Run

The most widely-spread of all snow sports, ski-ing, originated in Norway, but is now as extensively practised in Switzerland as anywhere. The ski itself (pronounced "skee," and not "shee," as is so often heard) is a flat piece of wood about six feet in length and four inches in width, curved upwards and pointed at the front end. It is attached to the foot by an arrangement of straps in the middle.

Two sticks, each having an iron point and a wooden ring near the point to prevent them from sinking in the snow, are necessary to enable one to stand steadily, and are used also as brakes.

A great advantage of ski-ing over tobogganing is that no specially-prepared track is necessary for the former. On the contrary, a slope of fresh snow is the place looked for by the ski-runner. Also he is not confined to gliding down slopes. A good speed can be attained on the level with little effort and hills are climbed without having to take off the skis. In this way another sport is made possible—mountain-climbing in winter, for many peaks that can be approached only in summer by the ordinary tourist are conquered in winter by the ski-runner.



Photo] [*C Brand*

Hockey on the Ice

A Glorious Experience

There is surely no more exhilarating and health-giving sensation than rushing silently down a mountain-slope on skis, alone, or perhaps with a dozen or more friends, jumping over mounds and touching the snow again some distance further down, almost

flying ; and all this in the glorious sunshine on a vast expanse of dazzling snow. Is it surprising that Englishmen go back year after year to Switzerland, if only for a few days, just to "have that thrill over again ? "

Enough experience to be able to descend short slopes on skis without falling can be gained in a few days, but there is much more to be learned. For experienced sportsmen with very strong legs and a clear head, there is that hair-raising " stunt " known as " Ski-kjoring." A ski-runner is attached a few yards behind a galloping horse—that is all. It does not seem very dangerous, but imagine what would happen if the runner let one ski swerve by half an inch, or if the horse slipped on the snow !



Photo] *[W. Gabi*

T. C. Carleton (Oxford 'Varsity Ski Team) in a jump turn at Wengen

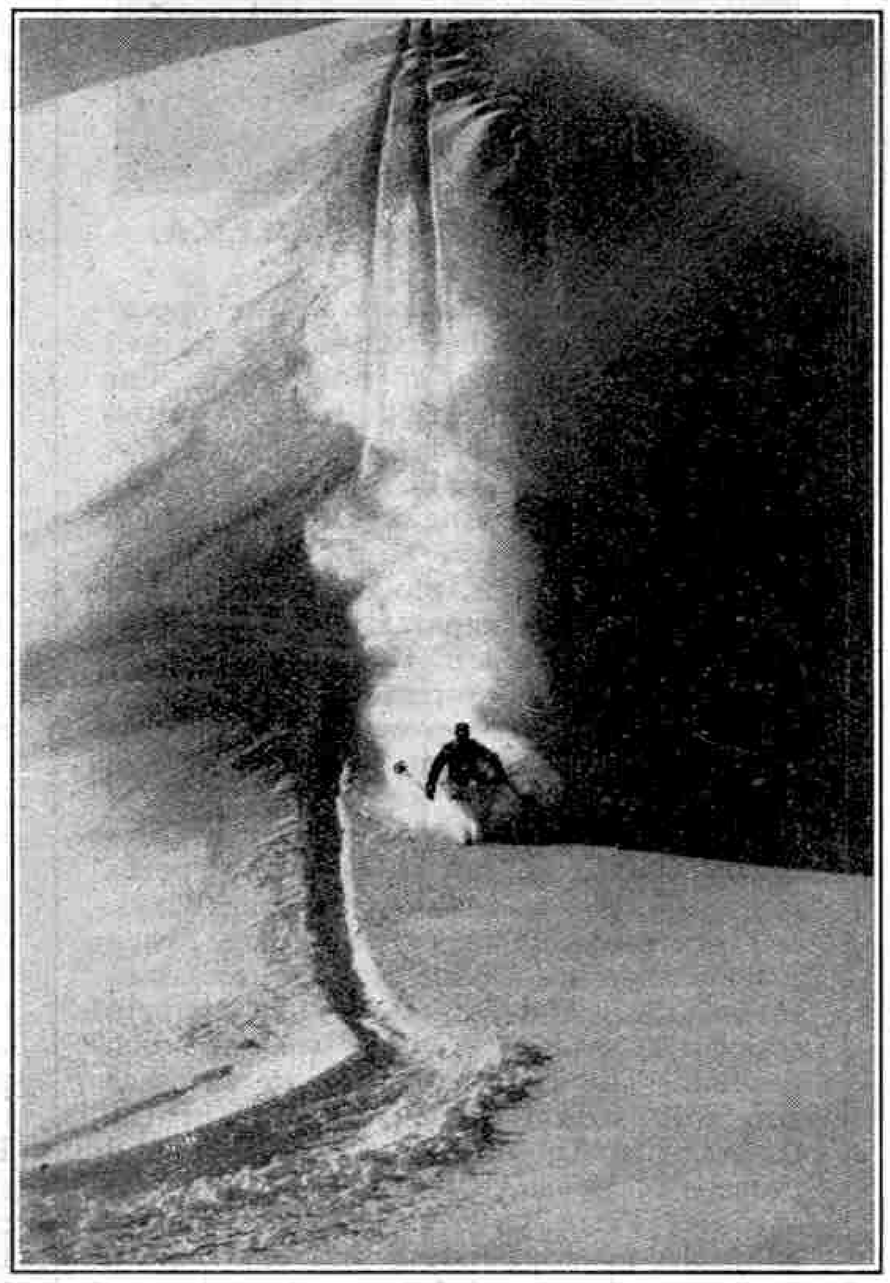
Another development of ski-ing is ski-jumping. The high leaps, attaining sometimes a length of over 120 ft., are really remarkable performances. These are done from special platforms situated on the side of a hill.

Ski-ing is not only a sport, but is used by the inhabitants of the mountain villages as the quickest and easiest means of locomotion. In many districts it is taught in the schools.

Skating and Ice Hockey

Skating is a pastime that is not confined to high altitudes, but for real artistic skating one must go to the rinks of the great hotels of St. Moritz, where world-renowned skaters from Norway and Canada can be seen, in the height of the season, performing remarkable feats. Ice-hockey matches take place on special rinks, the teams being, of course, on skates, and for the less juvenile visitors there is the fascinating game of curling.

Horse-races take place frequently on the lake of St. Moritz, frozen and covered with snow. Great international meetings are held, which attract crowds of visitors, and at which various races are run—flat races, trotting matches with specially light sledges, ski-kjoring races, etc.



Photo] *[E. Gyger*

A Thrilling Ski-run down the mountain side at Bei Adelboden

The principal centres for winter sports are naturally situated in the more mountainous parts of Switzerland, particularly in the Bernese Oberland, the canton of Grisons, and south of the lake of Lucerne.

The Bernese Oberland

The Bernese Oberland lies south of Berne and stretches from Gstaad at its western limit to Meiringen in the east. Interlaken is the centre from which most excursions can be made, but to find the mountain resorts one must go southward from there towards the Jungfrau. Here is Lauterbrunnen, in a deep valley, with Murren high up above on one side and Wengen on the other ; Grindelwald, world-renowned, near the foot of the Wetterhorn, and the Jungfrau itself, with its wonderful railway tunnelling through the heart of the mountain. From the last station on the line, Jungfraujoch, 11,340 ft. in height, can be made, even in mid-summer, that great excursion on skis to the Concordia hut, near the Aletsch glacier, a never-to-be-forgotten experience.

In other valleys are Kanderstag, at the entrance to the great Lötschberg tunnel, Adelboden, Gstaad and Lenk. St. Beatenberg, above the lake of Thoune, is also well known.

French Switzerland

French Switzerland boasts a number of first-class resorts, of which Caux and Les Avants are specially well equipped for all kinds of winter sports. Other places are St. Cergue and St. Croix, in the Jura mountains, and Morgins, Champéry and Montana in the canton of Valais.

Engelberg, reached by mountain railway from the shore of the lake of Lucerne, has every facility for winter sports, including excellent snow-fields for ski-running and a first-rate bobsleigh run.

All the above-mentioned resorts are well-known for their hotels and the perfection of their rinks.

(To be continued)

The Future of the Young Engineer

By W. Reavell, M.I.M.E. M.I.N.A.

The following address, given recently by Mr. Reavell at the Portsmouth College, is of such interest to our readers, that permission was obtained to reprint it in the "M.M." Mr. Reavell is the Vice-President of the Institution of Mechanical Engineers and Managing Director of a large engineering firm in Ipswich. His long experience and wide knowledge of his subject, entitle him to speak with authority on the subject with which he deals.—*Editor.*

SOME of you are probably entering upon the last year of your College course and are, no doubt, looking toward the future with mingled feelings of youthful hope and confidence, yet with a certain trepidation due to the growing complexities of modern engineering. I hope, however, that you all have the assurance that you have each "a Marshal's baton in your knapsack," as Napoleon said.

The observations I propose to put before you have the merit of being based on a somewhat long experience, and, as such, I hope they will renew your confidence and strengthen your courage.

From time to time 'dismal Jimmies' in the Press tell us that Engineering in England is 'played out' and that instead of leading, we follow either Continental or American practice! It is also often stated that the same opportunities of success do not occur to-day as in the past for the hundreds of trained young Engineers turned out each year from our Colleges.

Now while it is natural that, with the growth of scientific knowledge and its application to Engineering problems all over the world, we cannot expect to be the sole authors of Engineering invention or development, I do not believe in these pessimistic views and would ask you not to accept them.

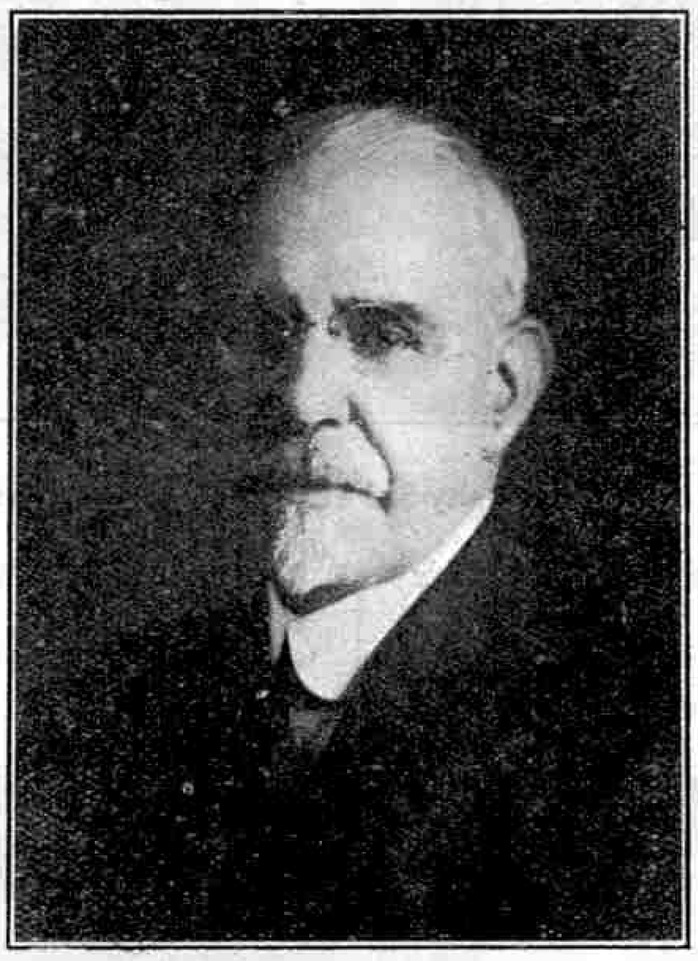
In dealing with this subject I do not propose to include the economic position —that is to discuss such things as the effect of lower rates of pay for skilled and unskilled labour on the Continent, the relative hours worked, or any kindred matters which have a bearing on the question of the disposal of our manufactured Engineering products abroad. I regard these questions, which would require an evening to themselves, as being outside the scope of my address to-night. I am only concerned with the nature and extent of the opportunities that lie before you.

Naturally Engineering development is full of difficulties—but at this fact I would ask you rather to rejoice, for it means that there will be opportunities to test your knowledge; and problems, the satisfactory solutions of which will not only redound to your own credit but be of benefit to your profession.

As you know, the fear of difficulties is not confined to this era. Epictetus wrote: "Difficulties are things that show what men are." This was true when that sentence was written, and it is true to-day.

I have a profound belief in the truth of that saying of Epictetus, and the history of Engineering in Great Britain is the history of difficulties patiently faced and surmounted by our forefathers, who were not technically equipped as you are, but who had the same British strain in them which will not admit of defeat.

Looking back on a fairly long life spent in the development of air compressing machinery of all kinds, I know of no greater feeling of satisfaction than that which comes from the solution of an unexpected difficulty by the application of intuitive knowledge and technical experience. Not infrequently it is by the solution of such difficulties that one is lead to actual improvements in design or construction.



Mr. W. Reavell, M.I.M.E., M.I.N.A.

I would ask you to look at the opportunities that now lie before the trained Engineer. Probably in no era in our history has Engineering been required in so many walks of life as it is to-day, quite apart from its development in the normal branches of Engineering with which you are more or less familiar. Contrast the kitchen of our modern houses and hotels with the preparation of meals in feudal times. Trace the hand of the Engineer in the preparation of modern clothing from the growth of the raw material onwards. Notice the rebirth of interest in irrigation for the increase in the Empire of that most important product, cotton; in our modern transport; in our sports, and in countless other ways.

There probably never was a time when Engineering knowledge was so necessary to our race, and consequently a time in which the trained Engineer was so much needed. The last generation or two has not only seen enormous strides in the branches of Engineering then known and practised; but in that period the romances of Jules Verne have been made real by triumphs in shipbuilding and engineering under the sea, and by successes in the sphere of aerial navigation; in respect of which British Engineers have played a not unworthy part.

Referring to that branch which I have presumed may be regarded as your speciality here, namely, Marine Engineering, I have seen enormous strides made since the days of my apprenticeship to Marine Engineering, when the compound engine and the Scotch or Locomotive boiler was recognised practice. Its legitimate successor to-day is the geared turbine and the water-tube boiler. I need not remind you of the enormous changes obtained by the use of this modern machinery, in economy, and in weight and space occupied, and consequently in the speed of vessels. That same period has also seen the birth and growth of the internal combustion engine, especially the type designed to use heavy oil, on the principle commonly associated with Dr. Diesel—although it is fitting to point out here that British Engineers generally agree that the real credit for the inception of the principle involved in this engine is due to Ackroyd, a British Engineer.

The development of both of these competitive types of machines for marine propulsion is still continuing.

With the turbine and the water-tube boiler we shall witness continuing progress, both in the use of superheat and still higher boiler pressures.

The boiler problem will involve considerations as to whether we shall continue to use boiler plates to the usual specification for mild steel and increase the thickness for higher pressures—suitably re-designing the machinery for rolling, bending, flanging and rivetting these thicker plates—or whether researches will give us a much higher tensile steel, thus reducing thickness but probably involving increased knowledge and care in the heat treatment at each stage.

The problem of auxiliary machinery, with its considerable relative effect on the total fuel consumption of the vessel, will be re-examined, not only for full speeds but also at cruising speeds, for it is unwise to strain at a further slight percentage gain with the main machinery when a considerable loss, which can be remedied, is taking place elsewhere in the engine room.

So far as the internal combustion engine is concerned, the battle will continue between the two-stroke-cycle and the four-stroke-cycle. Meanwhile, the practical development of the two-stroke double-acting engine will proceed apace. The use of the supercharger, in which so far the Continent has been leading us, will also have a growing effect on our practice.

Naturally that will not be the end. Proposals have already been made by eminent designers for the use of the compound principle in the internal combustion engine with heavy oil. These proposals include the use of a much higher exhaust pressure in the reciprocating engine, and the passing of this higher

pressure exhaust gas to an exhaust gas turbine directly coupled to a Turbo scavenging Compressor. This latter will deliver the air for combustion at higher pressures into the cylinder of the reciprocating engine, thereby providing more air, and therefore oxygen, per stroke. This will increase the amount of fuel that may be used economically per stroke, and largely increase the resultant power obtainable in a cylinder unit of given dimensions.

Developments will also take place by which the heat of the exhaust and the heat rejected with the jacket water are more completely utilised, all of which will have their effect in reducing the unit weight per h.p. and the space required for such machinery.

When you consider the developments that we have witnessed in one generation in the powers obtainable from the internal combustion heavy oil engine you are justified in concluding that the next generation will see a unit of improved type, suitable for the cruiser and the battleship.

Some of you will doubtless share in the work to be done in those developments, and will be able to look back on the practice of to-day as we look back upon the compound engine and Scotch boiler of two generations ago.

I have referred to Jules Verne and underwater craft. No one familiar with the submarine of to-day will accept the suggestion that finality in design and development has even been approached. It could never be so in a vessel that carries two complete and separate means of propulsion—one, the internal combustion engine for surface navigation, and the other the electric motor (with its resultant great weight of batteries and its relative inefficiency) for propulsion below the surface.

Then again, developments of even one generation by Engineers of this and other countries with regard to aircraft alone, are opening up a tremendous field for the young Engineer.

I remember, on my return from one of my visits to America, in 1909, I arrived in London just as the newsboys were selling special issues announcing the wonderful feat performed by the Frenchman Bleriot, who was the first man to succeed in crossing the English Channel in an aeroplane. In the short space of time that has elapsed since, we have seen the development of the airship envisaged by Jules Vernes, and the even more rapid development of aircraft of varying types. This has been so specialised for various purposes that to-day we have—in the class of aircraft known as 'heavier than air'—the fighting 'plane; the bombing 'plane; 'planes for passengers and mails; the seaplane, and the amphibian. Already these new developments are bringing the Dominions nearer to us, and the young Engineer who is following this branch of his profession has enormous scope in the work yet to be done, not only in the development of so-called heavy oil engines for aircraft, but in the improvements of the air 'planes themselves, giving increased flying speeds, reduced landing speeds and greater inherent stability.

The re-grouping of our Railways will give greater scope to transport engineers who are studying the more economical transit of goods in bulk. It will also offer opportunities for the use of new mechanical appliances for more quickly and economically handling goods at the termini.

In the field of locomotion on land for passengers and goods, we witness to-day continuous advances in the design of steam locomotives. Parallel with it, keen minds are working on the Turbo locomotive and the internal combustion locomotive, while others are engaged in simplifying and improving the equipment at present used in the application of electricity to Rail Locomotion. The electric locomotive is the sole means relied on for the underground electric railway—the new development that has come during the last two generations. Without it the problem of moving the masses of people in the crowded business areas of London and other cities would apparently have been insoluble. The Electric Loco, in its turn, has caused the passenger lift to be replaced by the moving stairway.

This is not by any means the whole story, for to-day we are witnessing a silent revolution taking place in our highways, due to the developments made in motor transport, both for passenger and goods. This brings us to improvements in roads and road construction.

The future historian will assuredly classify our time as the third epoch of British road-making. The Romans were our first Road-makers; Telford and McAdam resumed the task after fifteen centuries; now the work in progress far exceeds in magnitude anything that our fathers dreamed of. In its development the services of the Mechanical Engineer are more and more required for the construction of the necessary equipment.

In connection with road surfaces alone there is still an immense field for development before the perfect highway of the future is realised; and who can say what the effect of all these changes will be on our present conception of railway transport.

Looking back over a generation only, the Motor Engineer has made immense strides with the development of the motor engine and road-car. We have only to look at the system—already obsolete—of rating motor-car engines, to realise this. The Engineers of to-day ridicule the old method of rating engines, but at the time this method was introduced what is known as the "Square engine," i.e., with a stroke practically equal to the diameter of the cylinder, was common practice, while the h.p. resulting from the rating calculation was a fair indication of the power obtained. To-day this rating is as obsolete as the old rating of Nominal h.p. for the reciprocating Marine engine, which system of rating is now happily dead.

We have seen, in practically one decade, alterations in proportions of bore to stroke of motor-car engines; in mean effective pressures, and in piston speeds that have resulted in the actual b.h.p. of the engine to-day being over three times the motor-car rating.

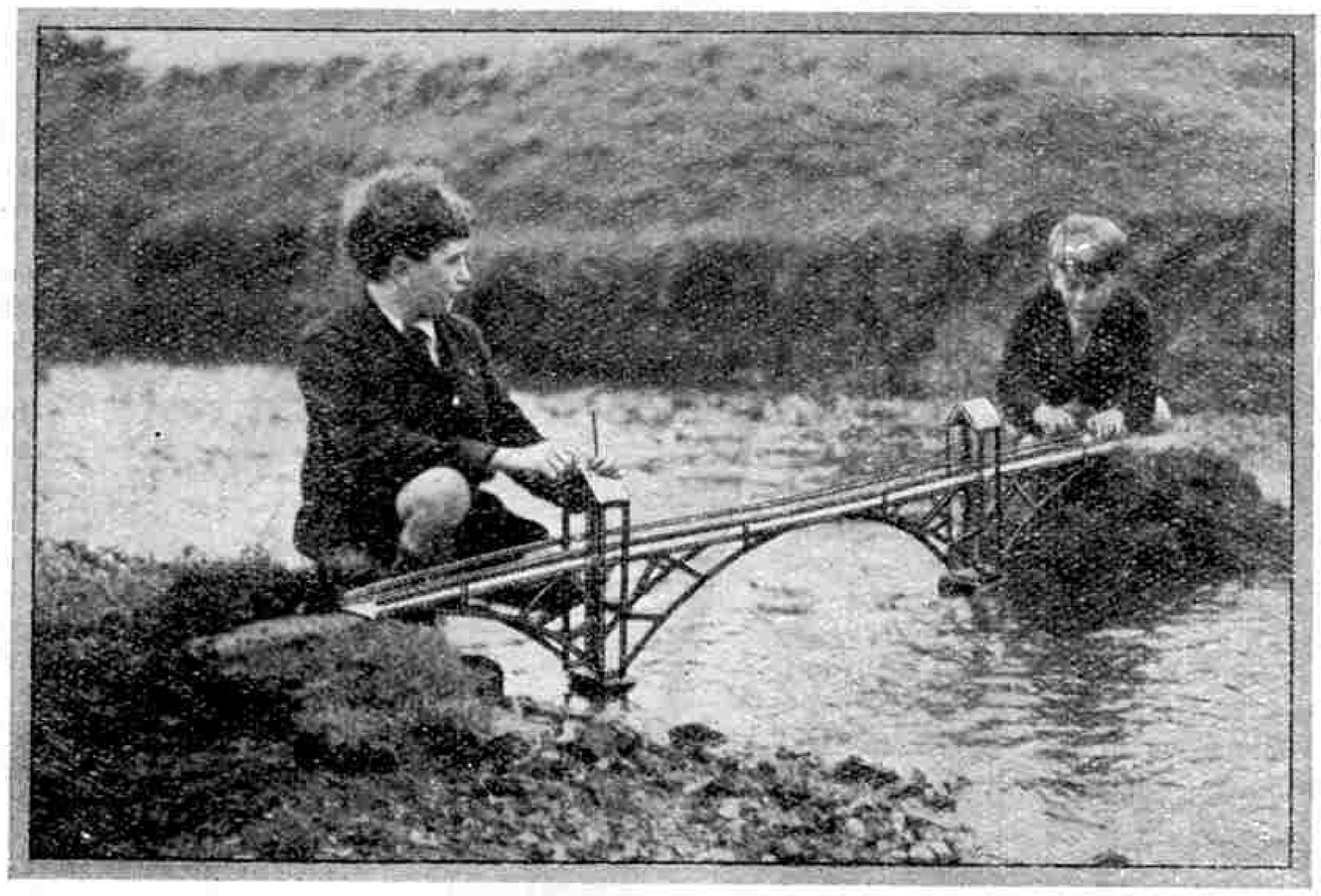
The Engineer has also invaded the ranks of Chemistry, and we now have a new school of Chemical Engineers who are destined to leave an increasing mark on the Engineering history of the future. Working with them is the Metallurgist, and the development of new alloys in the metallurgical Engineering has been most rapid. In nickel chrome alloys alone, recent researches have produced a new range of products that up to now, Engineers have never known.

We have also, in the production of Rustless Iron and Steel, valuable new materials to assist us in the construction of certain parts of machines where the materials previously used were unsuitable or more expensive. Developments in the nickel and iron series now give us a metal of high electrical permeability, of great service, for instance, in the production of electrical cables of the future. It is up to you, as Engineers entering on Engineering practice, to take full advantage of the possibilities that are revealed by these new discoveries.

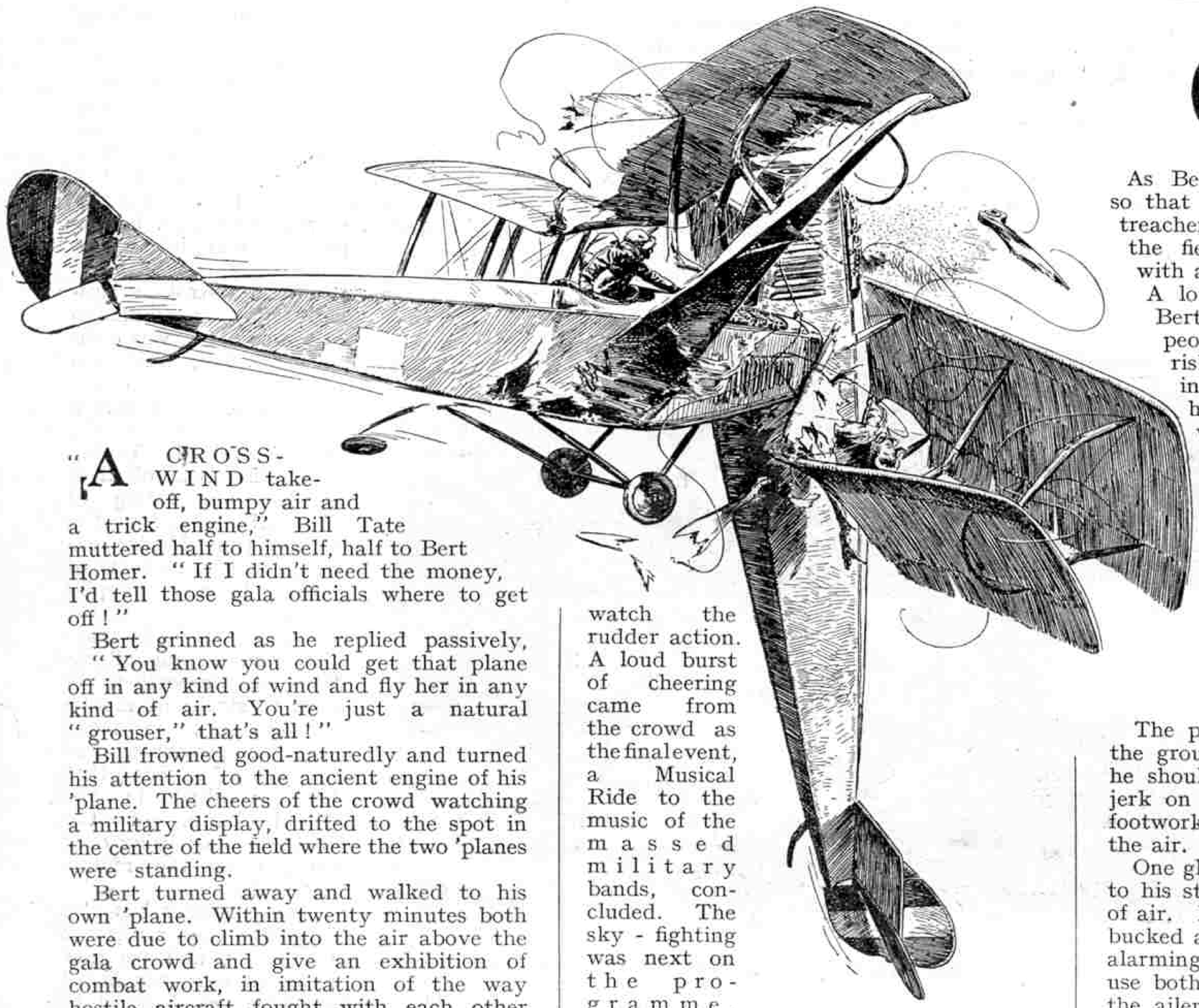
No reference to the work of the Metallurgist would be complete without alluding to its influence on the modern workshop. Some of you may become production Engineers, and bring your trained minds to bear on the increase of production possible from modern type tools, both in depth and speed of cut, with the modern cutting steels that the Metallurgist has provided.

Improved processes in the workshop is a fascinating subject, but it would require a separate paper to deal with it adequately. I would mention modern grinding processes, however, not only for more rapidly and accurately producing finished surfaces, but also for what is erroneously termed "rough grinding,"

(*Continued on page* 16)



Two Young Engineers of the Future Span a Stream in a Workman-like Manner



COMB

"A CROSS-WIND take-off, bumpy air and a trick engine," Bill Tate muttered half to himself, half to Bert Homer. "If I didn't need the money, I'd tell those gala officials where to get off!"

Bert grinned as he replied passively, "You know you could get that plane off in any kind of wind and fly her in any kind of air. You're just a natural "grouser," that's all!"

Bill frowned good-naturedly and turned his attention to the ancient engine of his 'plane. The cheers of the crowd watching a military display, drifted to the spot in the centre of the field where the two 'planes were standing.

Bert turned away and walked to his own 'plane. Within twenty minutes both were due to climb into the air above the gala crowd and give an exhibition of combat work, in imitation of the way hostile aircraft fought with each other during vivid days in France, when both Bert and Bill had been officers of the Air Force.

Both men had trained together in the South of England. Both had gone across on the same boat and learned real flying at Issoudun. At the front, too, with the Eighty-second Division they had taken the air for patrol work within a few minutes of each other every morning and afternoon.

Now with the lure of the air still upon them they were flying at seaside resorts, at galas and carnivals, where "stunt-flying" was still a novelty and an attraction to the holiday crowds. Because Bill had a mother and a sister to support, and Bert a badly gassed brother, they could not spare enough money to keep their aeroplanes in proper shape. The engines, the wing surfaces, the fuselages were all old.

"The air is bad," Bert conceded as he tinkered with the controls of his ancient 'plane, a ship made of parts of many other ships, "and Bill's worrying again. A nice combination!"

He pushed the "joy-stick" forward and leaned out of the fuselage to look back and watch the rudder action. A loud burst of cheering came from the crowd as the final event, a Musical Ride to the music of the massed military bands, concluded. The sky-fighting was next on the programme.

"Take things a bit easy, Bert. Keep ten or fifteen feet away in the loops," shouted Bill, who was ready and waiting to begin.

"All right, Bill, I'll give you plenty of air to-day. We'd better get up about seven thousand."

"That's plenty," Bill agreed. "And it should take us out of the bumps and give me a fair chance to hit the field if the engine goes bad."

Bert slipped deftly into the harness of his parachute and pulled on his helmet and goggles. He glanced at the sky. The day was hot and the long winding river in the vicinity was sure to make the air uncertain. His mechanic kicked the blocks under the wheels and spun the propeller downward. There was a staccato roar from the engine, and as he jumped quickly away the propeller began to spin. The 'plane strained at the blocks and quivered impatiently. The pilot listened for a few seconds to the low hum of the engine and waved a hand to Bill, who was already at his seat in his plane.

Good old Bill! It wasn't in his nature to take life so seriously as he had been taking it in the past few weeks, but he did have plenty to worry about—and worry affected Bill's flying. He was not so certain at the controls as he should be—not the Bill of war-time, who had shot down three enemy planes in three successive afternoons in Flanders.

As Bert began to prepare his 'plane so that it would get off into the gusty, treacherous wind that was blowing across the field he could see an announcer with a megaphone raised to his mouth. A loud cheer came from the crowd. Bert chuckled. It was odd how people liked to watch other men risk their lives. Thrills were scarce in this part of the country and he had no doubt but that he and Bill would put on a good show in this respect.

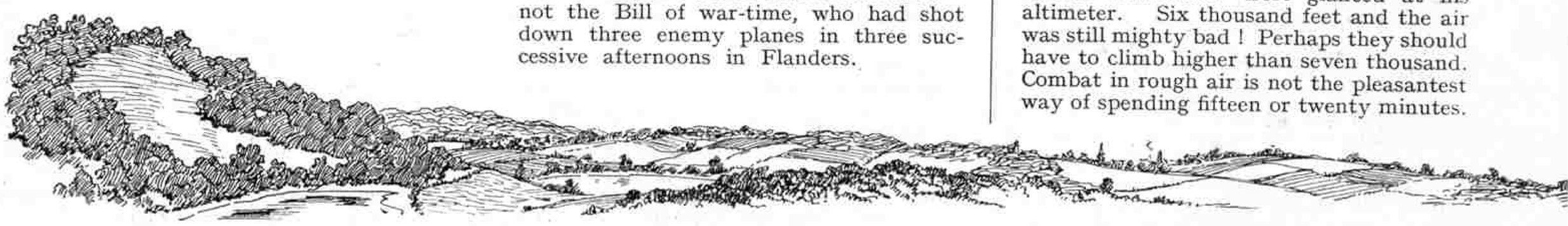
Bert opened the throttle. The roar of the engine suited him. The tail of the plane lifted slightly from the ground. He nodded to his mechanic to knock the blocks away from the wheels. Bill was "taxi-ing" into the wind, and Bert waved once more, manœuvred the ship into the gusts of warm air and "gave her the gun."

The plane skidded a little in getting off the ground, and for a second he thought he should crash. But after a desperate jerk on the "joy-stick" and some swift footwork on the rudder control she was in the air. And what air it was!

One glance showed him that Bill was off to his starboard, and that he had plenty of air. He needed it! The heavy biplane bucked and jumped, swayed and slithered alarmingly. At times Bert was forced to use both hands on the controls to adjust the ailerons quickly enough to meet the bumps. Seldom had he encountered such rough flying. And always he kept the nose of his 'plane just above the horizon. Always she was climbing up into the sky. Once the 'plane dropped sickeningly, and he had to point her nose down to bring her out of the drop. Bill, he knew, was faring just as badly as he and probably worse, for he had the added trouble of an antiquated engine that was not working well.

At three thousand feet there was slight let-up in the rough going. Again Bert picked up his companion's 'plane, which had climbed faster and was now several thousand feet above and did not appear to be having any trouble. Below was the river—a splash of greenish-blue that looked as if it had been dabbed into the brown of the country by a careless artist. The field was almost directly below them; in spite of the choppy air they had both climbed in wide circles.

At five thousand feet Bert's 'plane suddenly came alongside Bill's. Bill had probably been having trouble with his engine and was climbing more carefully, humouring it along. Bert waved a hand, and Bill answered by extending his left hand over the fuselage with the thumb turned downward. Bert glanced at his altimeter. Six thousand feet and the air was still mighty bad! Perhaps they should have to climb higher than seven thousand. Combat in rough air is not the pleasantest way of spending fifteen or twenty minutes.



AT! A Thrilling Story of the Air

By **Raoul Fauconnier Whitfield**

The roar of the engine was steady in Bert's plane. The "dope" on the wings reflected back the glare of the hot sun. Bert Homer loved the old ship for the fight she was making. Perhaps after a few more of these displays he would be able to afford a new engine, new cables and new parts.

Seven thousand feet below the river had become narrower, now, cutting across the green fields where the upturned faces of the crowd made tiny white specks. The air was not so rough but it was still too rough to be pleasant.

Both men kept their 'planes climbing until suddenly Bert saw that the exhaust smoke of Bill's 'plane was not steady. There would be a stream of it, then a space of clear air, then another stream. That meant that the engine was mis-firing! Bill's pessimism had been warranted.

Bert pushed the stick forward. Bill was flying level now, and the exhaust smoke was steadier. But once again he extended his arm as far over the fuselage as wind pressure would allow and turned the thumb of his right hand down—a sign that he was still having trouble.

Bert groaned. There would be no use in trying combat work if Bill's engine was mis-firing. Perhaps they could fix her up and still give the crowd the show. They needed the money, but if they didn't go through with their stunts, they certainly wouldn't get it—there was no doubt of that!

Bill also knew that they must go through with the show. He was game to the extent of folly at times and now, although his engine was still missing, he turned his thumb upward. That was the signal for the start of combat!

Mechanically Bert jerked his joy-stick back into his stomach. They always started by going each over in a loop. The nose of his 'plane went upward with a jerk. Up and up! . . . . Now she was over on her back, now plunging toward the earth. Bert pushed the stick forward to put the controls in neutral. The 'plane swooped downwards, every strut and wire quivering with the speed of her plunge. Then, with a fine, curving sweep her pilot brought her out of the loop.

He picked up Bill on the starboard, and kicking the right rudder smartly, he moved the stick to the right also. The 'plane went over in a right bank. At the same moment Bill banked vertically to his own right, and the two 'planes roared toward each other.

The mock combat had begun. Always these exhibitions took Bert back to the days in France when life was at stake; when life depended on the banks, the zooms, the loops and plunges of fighting ships; when life depended upon sighting the enemy 'plane from behind the Vickers or Lewis machine gun!

Loops, vertical banks, spins, dives and zooms! And whenever Bert had the chance he would watch Bill's exhaust smoke. Once when they were looping close to each other in an attempt to "get on the other's tail" he saw that Bill was having difficulty in his looping. He almost fell out of one loop into a dangerous spin, and spins meant too much loss of altitude, too much strain in fighting off the resultant dizziness and getting the 'planes on a level keel again.

Bert glanced at his altimeter. Six thousand feet! In spite of zooming up into the sky they had dropped down in their plungings and twistings. And only a few minutes of sham-fighting had passed.

Both 'planes raced toward each other again. Bert decided to loop over backwards and try to catch Bill going down in a plunging bank. Usually, when things were going better than they were to-day, the two found considerable fun in their combat work.

But Bill fooled him, for even as Bert pulled the stick back he saw the nose of Bill's 'plane go up. He knew in a flash that the two 'planes would come close.

Bill had been flying with a thirty-mile wind as he roared toward him. The wind would push him closer as it caught the zoomed surface of his plane. Bert drew in his breath and jammed the stick as far into his stomach as possible. A shadow flashed across his wing surface.

Bert's 'plane was standing on her tail now—standing straight up in the sky! In another second she would be over on her back, but that second never arrived. There was a sickening thud, a grinding of surfaces and for a brief instant Bert could hear the tearing and smashing of material by the propeller blades. The starboard wing bent slowly out of line and then collapsed with a terrific sound. Struts snapped like match-wood and wires, suddenly released, lashed wildly across the wreckage.

For a second Bert was stunned. But even as the wires were slashing and winding round the two tangled ships he ducked his head beneath the cockpit and loosened his stomach belt. His hands encountered the surface of the parachute. There was still a chance!

His head emerged. One thing was in their favour; no fire had resulted from the crash. The 'planes, twisted together, were beginning to fall and as they dipped to earth Bert had a fleeting glimpse of Bill, lying half out of the cockpit of his 'plane. His face was turned upward, and there was an ugly gash in his forehead. His eyes were open, and it seemed as if he were smiling.

Bert struggled out from the cockpit. The 'planes were twisting downward now with rapidly increased speed. They were beginning to spin, but their massed wreckage caused them to enter into the spin a little more slowly than generally happens with an uncontrolled 'plane.

Even as he grasped a loosened strut and pulled himself up, Bert realised that his pal's body was trapped by some wires. He was not more than five feet away, but crawling even that short distance was a desperate job, for the downward plunge of the 'planes was increasing in speed with every second.

Somehow he reached Bill and began tearing the wires that were tangled round him.

"I'm done, Bert—jump!" said Bill, but Bert only worked more desperately.

Finally he cleared the last wire and, twisting his feet around some of the wreckage, grasped with his left hand a projection in the cockpit and slowly dragged Bill out.

"Jerk that wire, Bill," he panted. "The wire that lets out your parachute. Jerk it when you count ten; you'll be clear then. Out!"

He gave Bill a desperate shove. With the spin of the ships Bill shot out grotesquely from their upper surfaces. Luckily they were not twisting end over end in the plunge.

"Fast!" Bert muttered to himself. "Fast!"

He was becoming dizzy now; he could scarcely see the wreckage. Everything was a blur. And each second they were plunging nearer to earth. A queer thought entered his head—at least the machines were fully insured. A queer thought, but it meant that, if only they both got to earth safely, they could have the new 'planes, new engines, new chances!

He fumbled for his own parachute. But he could not find the lead wire. It was dangling somewhere behind him, he knew, but where?

Suddenly the wreckage twisted. The motion was different now. There was a loud twang, heard even above the shrill song of the wind; another wire had snapped. The wreckage lurched end over end!

Bert released his grip on the projection in the cockpit. Instantly he was catapulted into the air. His hand was still fumbling for the lead wire as he reached the count of six. Panic seized him. Suppose he could not grasp it? Suppose he was too close to the earth already? It seemed as if an hour had passed since the crash!

And then his hand encountered the wire and almost mechanically he jerked it downwards. There was a snapping sound. The lead parachute—the little one that would pull open the big one—was out. He plunged downward like a plummet. Earth and sky merged into semi-darkness.

Then there came a louder snapping, a pull under his armpits. The harness to which the parachute was attached tightened round his body. He gulped in great breaths of the air. He was drifting. . . . .

Gradually he began to see again. Below were green fields—not far below, perhaps two thousand feet. A white arc of silk was spread above him over his head. He was drifting slowly to earth. He turned his eyes downward. Another arc of white was almost on the ground. So good old Bill had got away safely!

A dull boom filled his ears. He twisted his head to the right.

A cloud of yellow dust rose and hovered just off a winding road not far from the gala field. Instinctively Bert shuddered. If the crash had happened over the stands . . . . .

He could see the crowd running toward Bill's parachute, which was now almost to earth. In a few minutes more he should be down too—down and beside his pal. Thinking this he lapsed into semi-consciousness, and knew no more until he opened his eyes between white sheets in the local hospital. In the next bed was Bill! "Bill, old man," Bert whispered, when we take the air again we'll cut out the combat stuff and do loops or spins or vertical banks far apart. We haven't any business to be fighting each other anyway."

"Agreed," a weak voice murmured, "You know you are always right!"

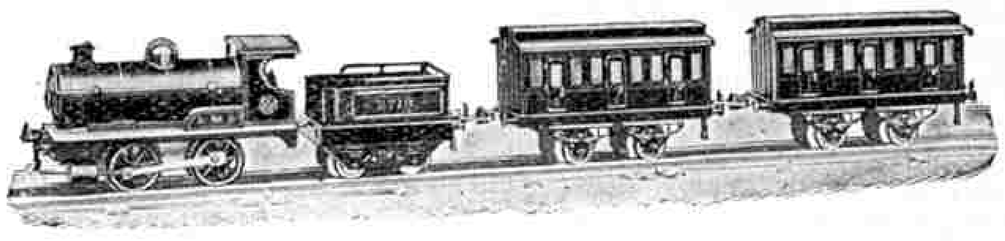
HORNBY CLOCKWORK TRAINS

BRITISH AND GUARANTEED

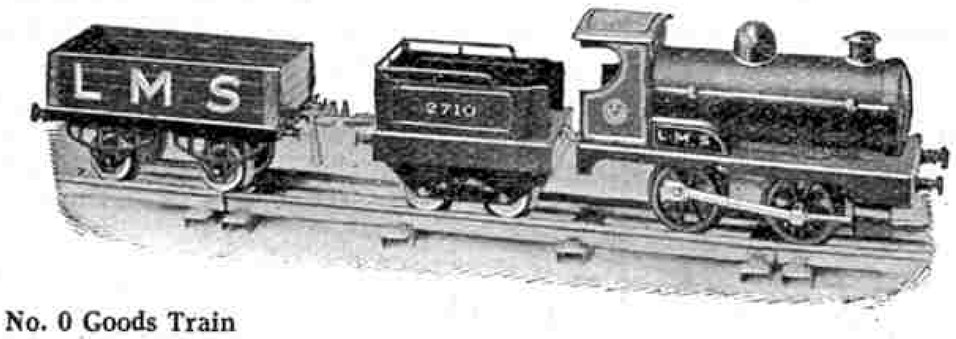
Hornby No. 1 Passenger Set

The set comprises Loco, Tender, two Passenger Coaches, and Rails to form a circle 2 ft. in diameter (including one Brake Rail, by means of which the train may be stopped from the track) and two Straight Rails. The Loco is equipped with reversing gear, brake and governor; the doors of the coaches open. In colours to represent L.M.S., G.W. or L.N.E.R. rolling stock. Gauge 0. Price, complete in strong box, **27/6.**

HORNBY No. 1 GOODS SET. This set is similar to the No. 1 Passenger Train but contains one Wagon in place of Passenger Coaches. Price, complete in strong box, **21/–.**



No. 1 Passenger Train



No. 0 Goods Train

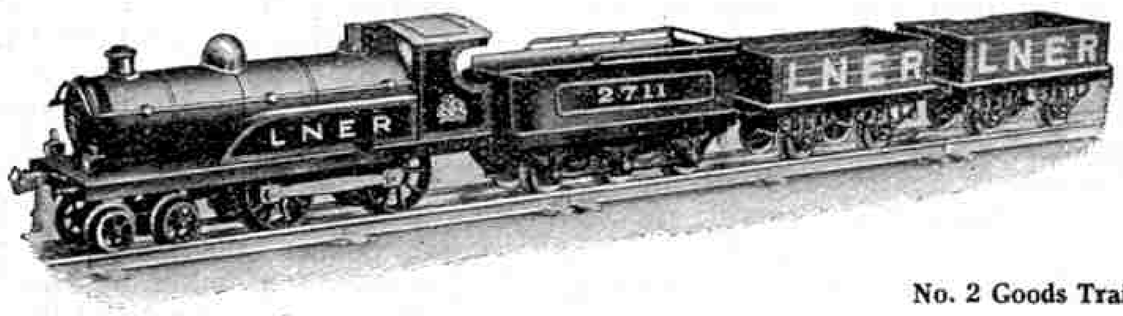
Hornby No. 0 Goods Set

Each set contains Loco, Tender, and one Wagon, with Curved Rails to form a circle 2 ft. in diameter and two Straight Rails. One of the Curved Rails carries a brake, by means of which the train may be stopped from the track. The Loco is fitted with brake and governor; non-reversing. Gauge 0, in colours to represent L.M.S., G.W. or L.N.E.R. rolling stock. Price, complete in strong box, **17/6.**

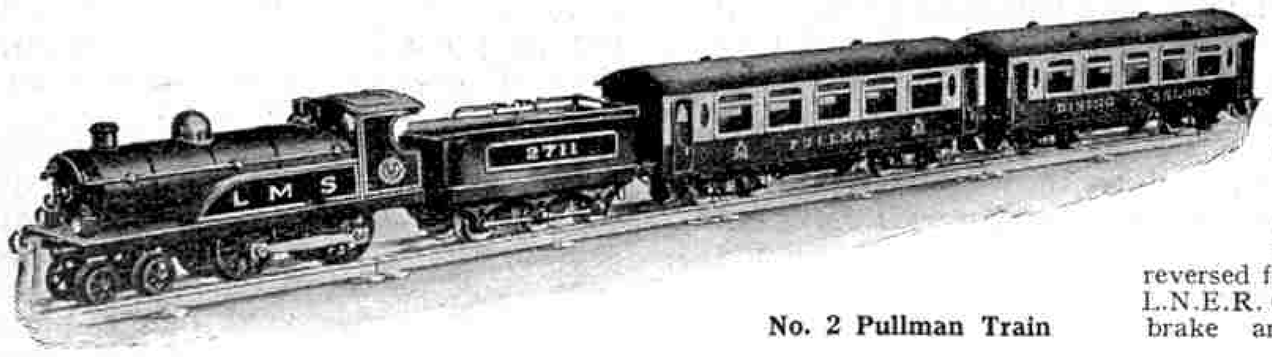
HORNBY No. 0 PASSENGER SET. This set is similar to the No. 0 Goods Train but contains two Passenger Coaches in place of the Wagon. Price, complete in strong box, **24/–.**

Hornby No. 2 Goods Set

The Loco, Tender and Rails of this set are similar to those in the No. 2 Pullman, but two Wagons take the place of the Coaches. As in all other No. 2 Hornby Trains, the Loco may be both braked or reversed from the track. The Loco and Tender are enamelled in black only, and lettered L.M.S., G.W. or L.N.E.R. Gauge 0. Price, complete in strong box, **37/6.**



No. 2 Goods Train



No. 2 Pullman Train

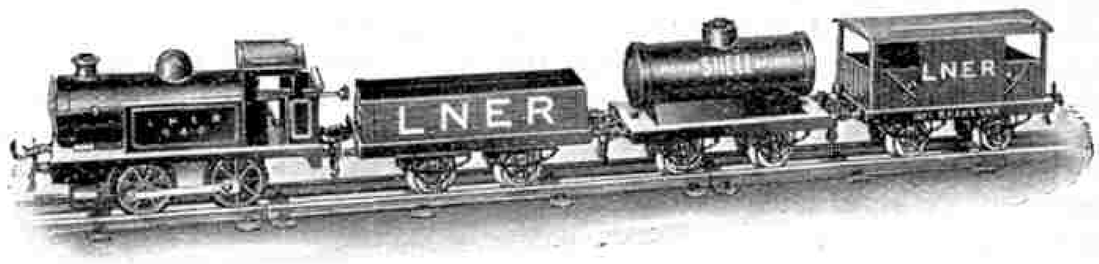
Hornby No. 2 Pullman Set

The Loco with Tender in this set measures 17 in. in length. A superior mechanism has been adopted, making it the most attractive and satisfactory clockwork train yet produced. The Coaches are beautiful both in colour and finish. Each Set includes Loco, Tender, and two Pullman Coaches, with Set of Rails to form a circle 4 ft. in diameter. The rails include one Brake Rail by means of which the train may be both braked and reversed from the track. In colours to represent the L.M.S., G.W. or L.N.E.R. Companies' rolling stock. The Loco is fitted with reversing gear, brake and governor. Gauge 0. Price, complete in strong box, **60/–.**

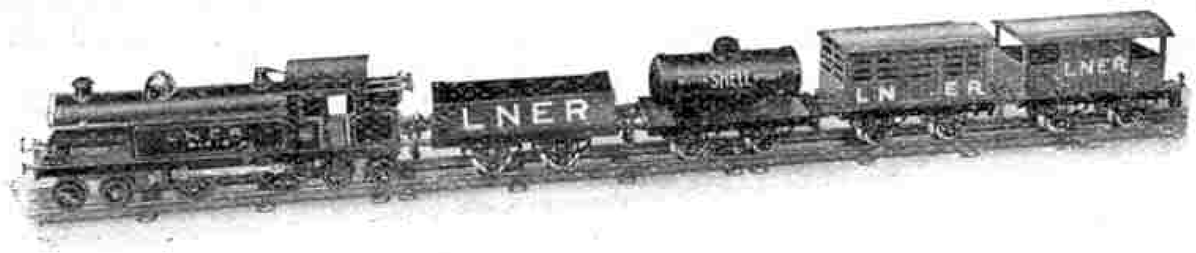
Hornby No. 1 Tank Goods Set

This set contains a No. 1 Hornby Tank Loco, Hornby Wagon, Petrol Tank Wagon, Brake Van and set of Rails to form a circle 2 ft. in diameter, and two Straight Rails. The Loco is fitted with brake, which may be operated by a lever in the cab or from the track, reversing gear and governor. Gauge 0.

In colours to represent the L.M.S., G.W. or L.N.E. Railway rolling stock. Price, complete in strong box, **25/–.**



No. 1 Tank Goods Train



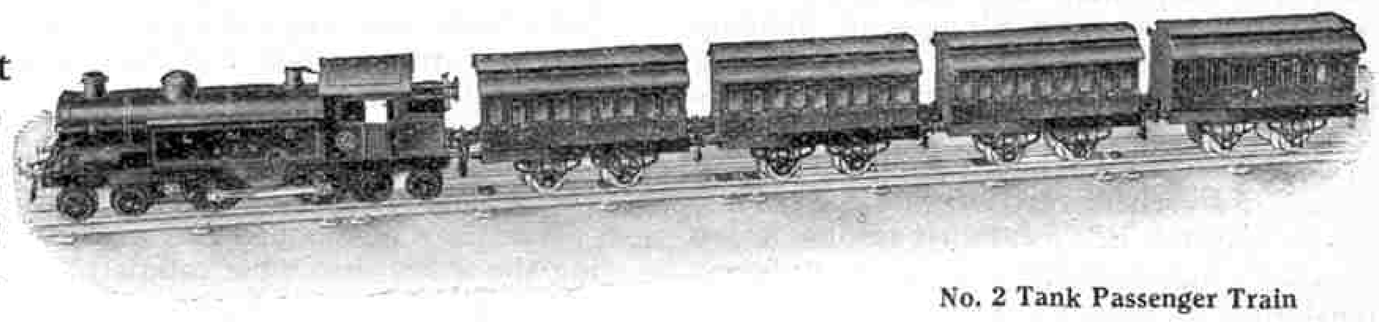
No. 2 Tank Goods Train

Hornby No. 2 Tank Goods Set

The rolling stock of this realistic goods train consists of a No. 2 Tank Loco, Hornby Wagon, Petrol Tank Wagon, No. 1 Cattle Truck, and Brake Van. The Loco may be braked and reversed from the track—which forms a circle 4 ft. in diameter—or from levers in the cab. The No. 2 Hornby Tank Loco is 11½ in. in length and is fitted with leading and trailing four-wheeled bogies. Gauge 0, in colours to represent the L.M.S., G.W. or L.N.E. Railway Companies' rolling stock. Price, complete in strong box, **45/–.**

Hornby No. 2 Tank Passenger Set

This set contains a No. 2 Hornby Tank Loco, three Passenger Coaches, Guard's Van, and set of Rails to form a circle 4 ft. in diameter. One of the Rails is fitted with levers by means of which the Loco may be both braked and reversed from the track. Gauge 0, in colours to represent the L.M.S., G.W. or L.N.E. Railway Companies' rolling stock. Price, complete in strong box, **45/–.**



No. 2 Tank Passenger Train

FROM ALL MECCANO DEALERS

New Petrol Locos for British Guiana

Two Interesting Internal-combustion Locos for West Indian Sugar Estates

THE usefulness of internal combustion locos was proved beyond doubt during the War, when petrol locos were built in large numbers. They ranged from tiny machines designed for the narrow-gauge lines of the Western Front to large and powerful locos weighing 26 tons each. Between these extremes were many different types, including various road vehicles that had been adapted for railway work. The largest of the war-time petrol locos were fitted with a marine-type engine of 180 h.p. Starting and reversing was done by compressed air, which also operated the Westinghouse brake. One of these locos was captured with its Australian crew in 1918 while hauling a Naval gun weighing 100 tons.

An interesting recent development in railway practice is the employment of internal combustion locos for shunting operations. In this work long spells of standing-by cannot be avoided and a petrol loco has a great advantage over a steam loco in that it consumes no fuel during these idle spells. Further, a petrol loco is ready for service at practically a moment's notice, whereas with an ordinary steam loco considerable time must elapse after the fire is lit before the necessary steam pressure is raised.

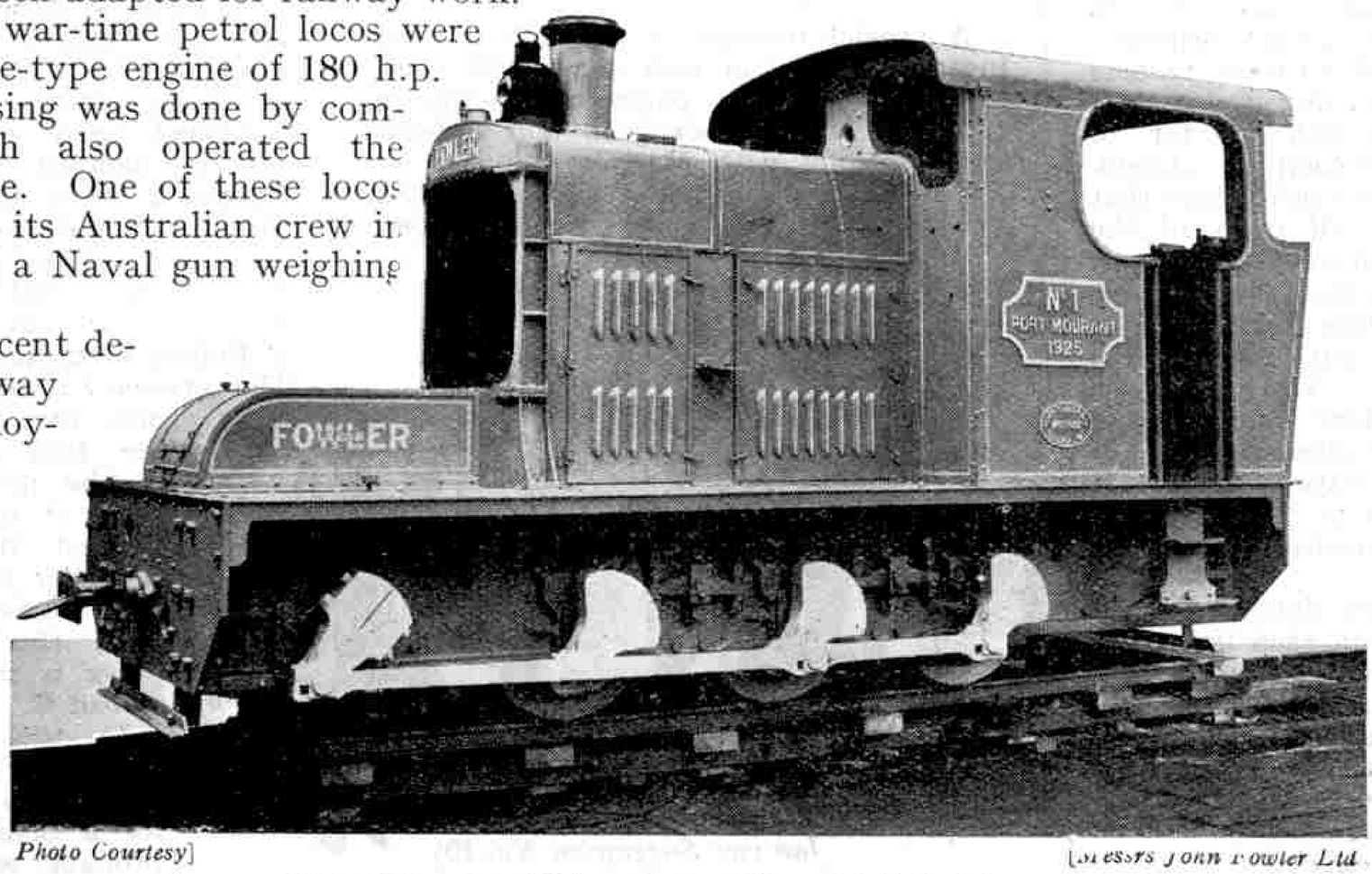


Photo Courtesy [Messrs John Fowler Ltd.

One of the new 80 h.p. 6 wheel Coupled Petrol Locos

The use of internal combustion locos is not by any means confined to shunting, however. For instance, two interesting locos of this type have been built by Messrs. John Fowler & Co. (Leeds) Ltd., for service on sugar estates in British Guiana. In the first place the inquiry came forward for a light railway of 3 ft. gauge for transporting native labourers over a distance of about 4½ miles on the plantations, with equipment capable of conveying 1,000 labourers per hour.

On account of the intermittent nature of the work and the fact that cheap alcohol fuel was available, motor locomotives were recommended. Alternative types of 60 h.p. 4-wheel coupled and 80 h.p. 6-wheel coupled locos were put forward. Although the makers were of opinion that the former locos would have been quite capable of doing the work, they would have been fully loaded, and therefore the larger engines were decided upon in order to give a comfortable reserve of power without a great increase in the initial cost.

These locos are fitted with heavy duty vertical engines of the Ricardo slipper piston type, having four cylinders 5⅝ in. bore by 7½ in. stroke, running at a normal speed of 1,000 revolutions per minute. Governors are fitted to prevent racing.

The wheels of the loco are 30 in. in diameter and the total wheel base is 6 ft. 6 in.

A three-speed gear box gives normal running speeds of 3, 5 and 9 miles per hour, with a calculated tractive force at the slow speed of 7,500 lb. The gear box is totally enclosed and all shafts and gears are of heat-treated steel, ground after hardening and running in oil.

The bevel reversing gears are fitted in a separate case and give reverses on all speeds. From these the drive is transmitted to a cross shaft and then by connecting rods to the driving wheels of the loco. Chains are eliminated, and with them the consequent wear and necessary adjustments.

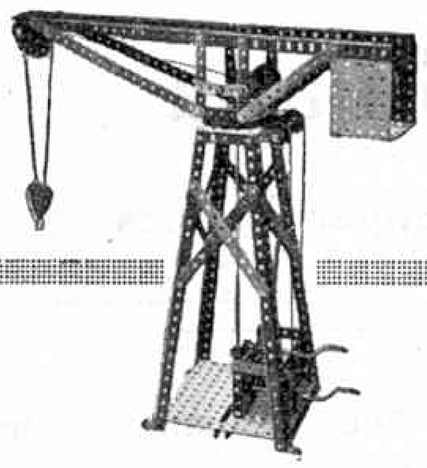
Ignition is by magneto fitted with impulse starter to give an increased spark when starting, and the carburettor is suitable for petrol, benzol or gasolene. Special vaporisers can be fitted to enable paraffin, kerosene or alcohol to be used.

The locos are fitted with a cab for the driver, and a chimney is provided to carry the exhaust gases well clear of driver and passengers. The approximate weight of the loco complete is 16 tons.

For use with these locos Messrs. Fowler have supplied twenty passenger cars each capable of seating 50 natives. One of these cars was built up complete on this side as a pattern and the remainder were constructed in British Guiana from local wood, the ironwork being supplied by Leeds.

A smaller loco of this type was recently exhibited by Messrs. Fowler at the Royal Agricultural Society's show at Chester. This loco is of 30 h.p., is to run on a 2 ft. 6 in. gauge track and has 2 ft. diameter wheels. The cylinders are 4⅜ in. diameter by 5¾ in. stroke and the loco, which weighs about 6 tons in working order, is of the 4-wheel coupled type. Two 30 h.p. locos of this kind have been shipped to the Thakur Sahib of Rajkot, India.

Internal combustion locos undoubtedly have great possibilities for intermittent railway work. In many parts of the world where light railways are needed, petrol and other liquid fuels are obtainable much more easily than coal, and the internal combustion loco is likely to be preferred.



Suggestions Section

Edited by "Spanner"

An Acknowledgment

The "Suggestions Page" has met with a prompt and very gratifying response. We should like to thank all those readers who have written concerning it, for their whole-hearted support will go far to make the new venture a complete success.

The ingenious and practical ideas that have reached us from all parts of the country came in the nature of a pleasant surprise—so pleasant, in fact, that we hope the size of every future mail will be sufficient to prolong our condition of amazement indefinitely! One result attributable to our readers' splendid response is found in the alteration to the title, "Suggestions Page," which now becomes "Suggestions Section"—the original idea of one page being hopelessly inadequate!

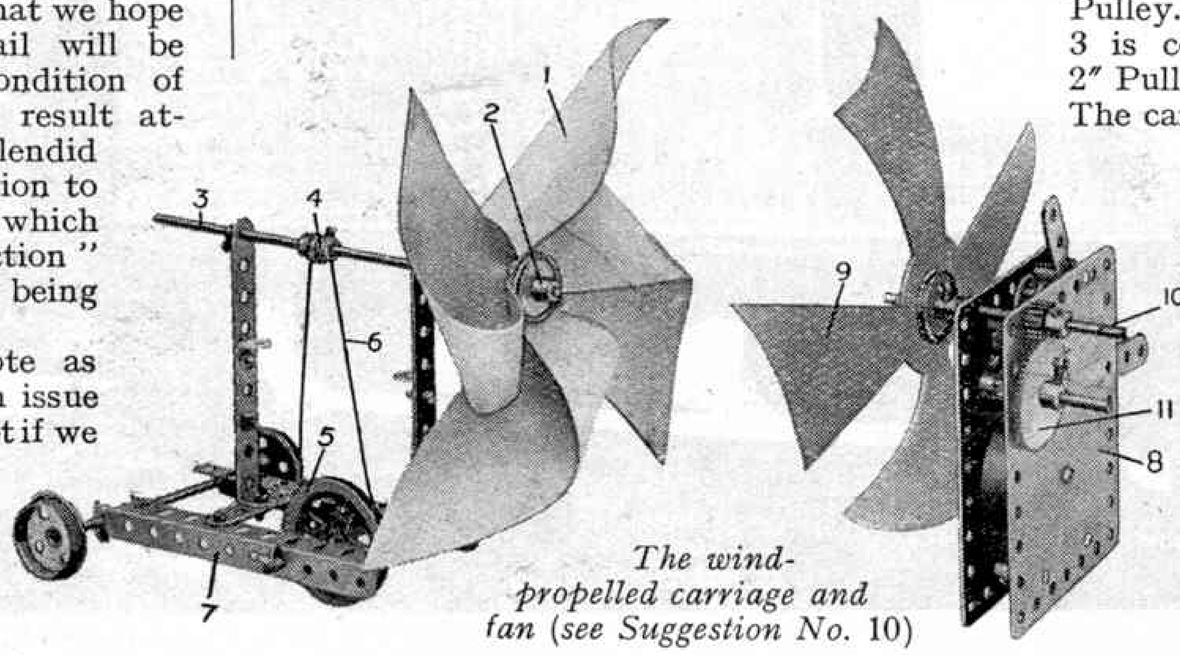
We shall continue to devote as much space as possible in each issue to this feature, although we doubt if we could accommodate all the suggestions received, even if we filled six or seven pages every month! With such a host of contributions and ideas to choose from, it is to be expected that only those showing outstanding merit will be published, yet in spite of a critical and impartial examination of every entry, there is already a "waiting list" of contributions for which we intend to find space in future issues.

Further contributions for this Section are invited. Articles may deal with any subject likely to interest Meccano boys, and should be accompanied by drawings or photographs if possible. Do not hesitate to send rough sketches, for if the idea is suitable for publication, we will have new drawings made by our artists. Special awards of five shillings each will be paid for any suggestions published showing special merit, whilst the senders of all other contributions used (not including, of course, those mentioned under "Replies") will be presented with complimentary copies of the new "Meccano Standard Mechanisms" Manual.

(9)—Another Meccano Sidecar Outfit

A special interest will attach to this ingenious model in view of the fact that, elsewhere in these pages, a description is given of a Motor-cycle and Sidecar built entirely with Meccano parts.

The model shown below was constructed by Mr. J. R. Lancaster, of Cleethorpes.

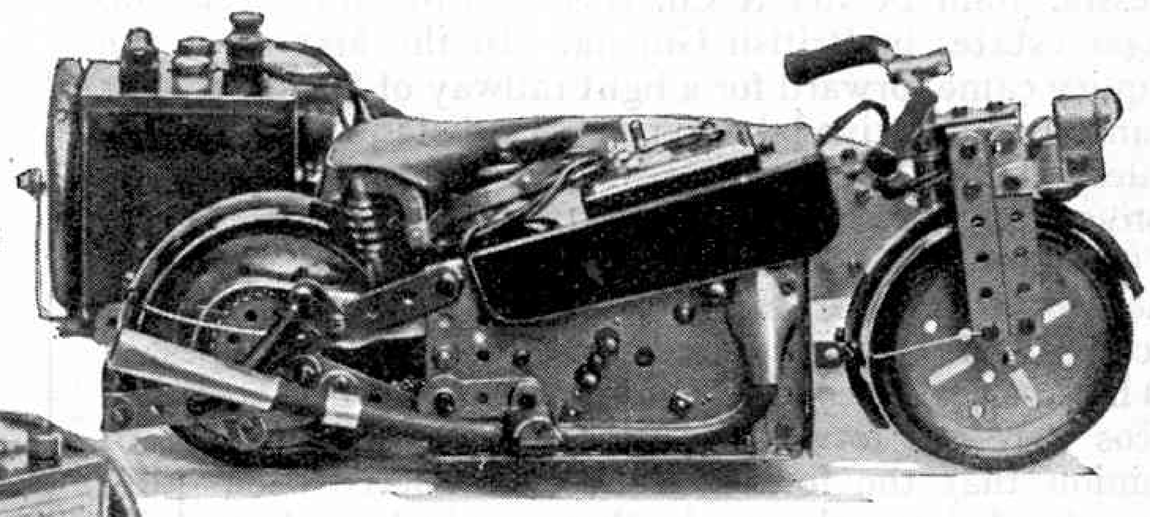


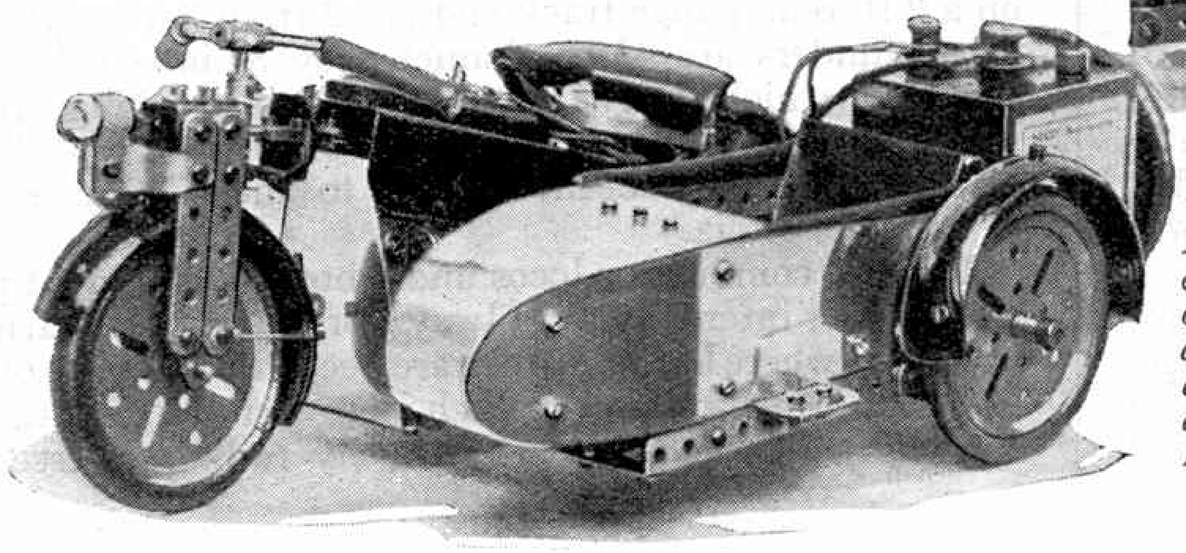
The wind-propelled carriage and fan (see Suggestion No. 10)

Although certain other elements have been introduced, it consists chiefly of Meccano parts, and is driven by a Meccano Electric Motor and Accumulator. The inclusion of this large power unit rendered the task of obtaining a symmetrical finish to the model far more difficult; yet the complete outfit is very pleasing and most realistic in appearance. The efficiency of its operation, also, affords ample testimony to the ingenuity shown in its construction.

The Electric Motor is skilfully embodied in the cycle, giving it the appearance of an all-enclosed P. and P., while the Accumulator is

(*Continued on next page*)





Two views of Mr. J. R. Lancaster's sidecar outfit, chiefly composed of Meccano parts and driven by an Electric Motor.

Courtesy of "The Motor Cycle"

(10)—Wind as Motive Power

H. Leay (Wallasey, Cheshire) submits a very interesting model in which he employs wind power as a novel means of propelling a small carriage. The propeller 1 is fashioned from a sheet of cardboard and is clamped between two 1" fast Pulleys 2 on a Rod 3, the four outer corners of the propeller being doubled back and nipped behind the front 1" Pulley. A ½" fast Pulley 4 on the Rod 3 is connected to the road wheel 5 (a 2" Pulley) by means of a piece of thread 6. The carriage 7 is mounted on three wheels, and care should be taken to see that it runs very easily. If the model is placed in the open, it will be found that the faintest breeze will start the propeller spinning; this causes the carriage to travel along, since the motion of the propeller is transferred through the thread 6.

In this cold weather, however, one sometimes feels disinclined to venture out and wait for a breeze to spring up, and probably with this point in mind, our contributor suggests a means of producing a very effective indoor draught that will suit the purpose! A fan-wheel 9 is shaped from a piece of cardboard and secured to the Rod 10, and a Pinion on the latter is driven from a Gear Wheel 11 on the shaft of the Clockwork Motor 8. The blades of the fan should be bent as shown in the illustration; they must consist of very stout cardboard, else they will flatten out in rotation and so offer little resistance to the atmosphere. The draught created by the fan when revolving at maximum speed, if directed towards the propeller 1 from a distance of roughly a yard, should cause the carriage 7 to commence to move.

An Electric Motor may be substituted for the Clockwork Motor, so increasing the range of operation to a considerable extent.

(11)—Jockey Pulley for Horizontal Belt

(*John Shaw, Birch Vale, Stockport*).

In view of the special attention that has been paid in the Magazine recently to Meccano Belt and Rope Mechanism, Pulleys, etc., the publication of two

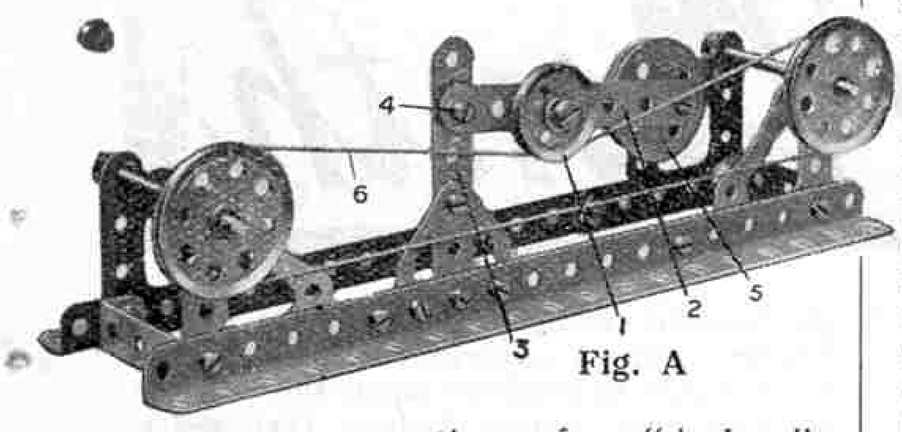


Fig. A

interesting suggestions for "jockey" pulley apparatus should prove both timely and serviceable.

Fig. A shows a simple type of jockey pulley device, suitable for horizontal belt drives. The "jockey" 1 is journalled on a Pivot Bolt secured to a lever 2, which is attached pivotly to the upright 3 by means of bolt and nuts 4. The weight of a Flange Wheel 5, attached to the outer end of the lever 2, exerts a certain pressure through the Pulley to the belt (represented by cord 6). The extent of the pressure may be varied, according to the "load" on the belt, by altering the weight on the end of the lever.

With this apparatus, a reliable non-slip belt drive will be obtained, for any "slack" produced in the cord 6 is taken up immediately by the pressure of the Pulley 1.

(9)—Meccano Sidecar Outfit—(*continued*)

carried on the luggage grid at the rear of the sidecar. The handle-bar grips are fashioned from John Bull control lever rubbers, and a miniature Terry saddle is employed.

It will be noticed that the drive from the Motor is led by Sprocket Chain to a 1½" Sprocket Wheel secured to the axle of the rear road wheel. A neat starting switch, having the appearance of a clutch and gear-change lever, is fitted to the top of the petrol tank, while a spring-up rear stand and twin "super-sports" exhaust pipes complete the model.

This Month's Awards

Five shillings will be awarded to each of the contributors concerned for Suggestions Nos. 10, 11 and 12.

Suggestions Received

The following Suggestions have been received and are having attention: Compass (R. Garton); Hack Saw (G. Boedeker and Albert Pryce); Fret Saw (D. G. Knibbs, Oswald Yeomans, Herbert Hart, and others); Brace and Bit (G. Muirhead); Pit Winder (George W. Waples); Slip-Coach Device (John Scrivener); Steam Dome (Charles W. Parkin); "Toaster" (E. W. Griffith); "Cum Bak" and Bendix Drive (Carl W. Beese); Rail Detonator (Norman F. J. Ward and D. F. Haslewood); Ball Bearings (E. P. Beazley); Centrifugal Governor (R. H. Wiegold); and many others.

Meccano Pulley Blocks

We regret that a printer's unfortunate error occurred in the "Standard Mechanisms" article in certain copies of the December *Meccano Magazine*. In every copy, the caption under the illustration in the centre of page 636 should read "Fig. 3: the Two-sheave Pulley Block," whilst the caption under the illustration in the bottom right-hand corner should read "Fig. 2 the Single Movable Pulley."

(12)—Belt Adjusting Apparatus, or Jockey Pulley

(*J. Mercer, Blackburn*).

The apparatus illustrated in Fig. B departs somewhat from the usual practice of employing a jockey pulley to take up the slack in a belt. Our contributor suggested that one of the belt pulleys should be controlled by a screw adjustment in such a way that the distance between this pulley and the second belt pulley may be increased or decreased at will. Thus, the grip of a worn or stretched belt may be tightened by a movement of the screw gear, thrusting the belt pulleys further apart. This device would be applicable to one or two Meccano models, but we find that the necessity of mounting one of the belt pulleys on a variable pivot more often proves an inconvenience, and we have therefore incorporated the adjustment device in a third independent Pulley.

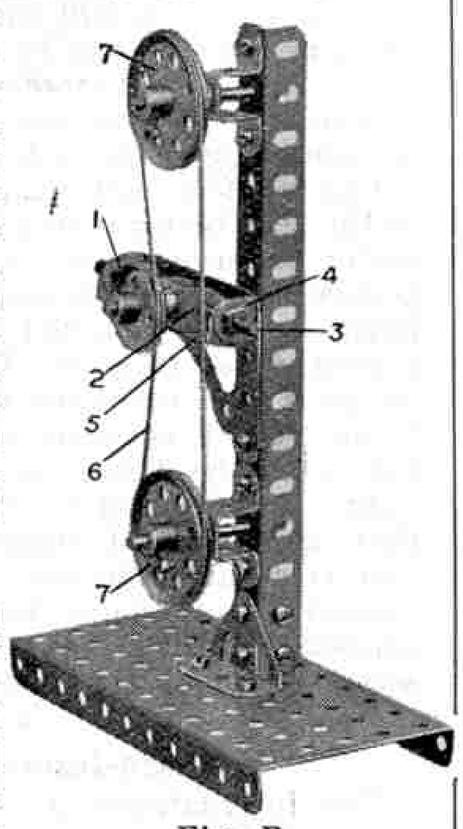


Fig. B

In the model illustrated, a 1" loose Pulley 1 rotates freely on a 1" Rod secured in the boss of the Fork Piece 2. The latter engages a 3½" Threaded Rod 3 which is secured by means of two nuts at either end to a Double Angle Strip 4. A similar strip 5 is mounted in an inverted position, and maintains the Fork Piece 2 in a horizontal position. The Rod 3 passes completely through the longitudinal bore of a Threaded Boss, which is mounted immediately behind the Fork Piece 2. A few turns of this Threaded Boss will force the Fork Piece, carrying the jockey pulley, towards the belt 6, so increasing the grip of the latter upon the Pulleys 7.

One of the advantages of the screw-adjusted jockey pulley is found in the fact that the pressure of the belt may be varied according to the load on the belt pulleys; thus, when little power is required to drive the pulleys, the belt may be "slacked off" to allow for easy running. The device may even be employed as a form of clutch mechanism. For this purpose a very slack belt is used, so that if the pressure on the Pulley 1 is relaxed, a point will be reached when the belt refuses to grip the belt pulleys. The driving pulley is able then to revolve freely.

Suggested Hornby Improvements

SIGNAL GANTRIES.—Signal gantries are seldom called for with Hornby Trains, for the Junction Signal, or Footbridge with Signals, meet the requirements of the majority of layouts. (*Reply to B. K. Causley-Smith, West Clandon, Surrey, and J. C. Dewing, London, N.*12).

BOGIE PASSENGER COACH.—The new Metropolitan Passenger Coach should serve the purpose of your suggested two-bogie coach for ordinary passenger traffic. (*Reply to J. C. Dewing, London, N.*12 *and E. W. White, London, N.*1).

"ISLAND" PLATFORMS.—The suggestion for an "island" platform, permitting trains to draw up on either side, will receive further consideration. (*Reply to Sidney Hunt, Grimsby and E. W. White, London, N.*1).

In Reply

Suggested Meccano Improvements

"MECCANO BOOK OF ENGINEERING."—We have noted your suggestion that a book should be published dealing with Meccano and Engineering, in a similar style to the popular Hornby Book of Trains. No doubt you will find that a step has been taken in this direction in "Meccano Standard Mechanisms." (*Reply to Percy Booth, Limehurst, Ashton-u-Lyne*).

PREVENTING RUST.—To coat all parts with a solution to prevent rust would be a costly process. Meccano parts should remain in good condition for some years, providing they are kept always free from damp and replaced in their box when not in use. (*Reply to Harold Michel, London, E.*8).

Suggested New Meccano Parts

BEVEL WHEELS AND RODS.—Bevel Wheels of ½" and 1½" diameter would duplicate the functions of the ½" Pinion and 1½" Contrate Wheel. Axle Rods 24½" and 36" in length would lack rigidity, and are seldom called for. Moreover, they would be difficult to pack or to handle generally. (*Reply to J. L. Cannell, London, E.*12).

BASE PLATES.—Large Base plates would be applicable to very few models; when such a base is required, we consider it preferable to build it up from existing parts. (*Reply to D. Cozens, Alberni, B.C., and J. L. Cannell, London, E.*12).

6" GEAR WHEEL.—The occasions on which 6" Gear Wheels are required must be very few. We find the 3" size sufficient for nearly all purposes. (*Reply to D. Cozens, Alberni, B.C.*)

PIPING AND STEAM ENGINE PARTS.—The addition of pipes, cylinders, etc., for the construction of working model steam engines is not practicable, at least for the immediate future, owing to the large number of entirely new elements that it would be necessary to introduce to the system. (*Reply to R. Hollowell, London, S.W.*15).

CURVED PLATES.—Curved Plates and other elements are continually receiving attention, but much difficulty is experienced in standardising such parts with the existing system. (*Reply to D. Cozens, Alberni, B.C., and Harold Michel, London, E.*8).

LARGE BUFFERS.—Buffers suitable for large models of locomotives may be constructed from ½" or 1" Pulleys secured to Axle Rods sliding in any suitable bearings, and controlled by Springs. We do not think the demand at present justifies the inclusion of a separate unit for this purpose. (*Reply to Harold Michel, London, E.*8).

Suggested Hornby Improvements

MAIL VAN.—We shall consider the possibilities of an eight-wheeled mail van, together with a way-side standard and net, miniature mail-bags, etc. (*Reply to Edward Ingate, Aylsham; Percy Booth, Limehurst, Ashton-u-Lyne; C. J. Longland, Songea, Tanganyika Territory; H. R. Trim, Guildford; George Armson, Syston, Nr. Leicester, and others*).

TERMINAL STATION.—The addition of a suitable terminus for model railways, with "arrival" and "departure" platforms, will carefully be considered. (*Reply to Molly Quennell, London, N.W.*5; *and Edward Ingate, Aylsham, Norfolk*).

STATION NAMEPLATES.—Your suggestion regarding small plates bearing names of various stations and designed to fit into slots provided in the Hornby Station and Signal-box is interesting, and we shall consider it further. (*Reply to Percy Booth, Limehurst, Ashton-u-Lyne*).

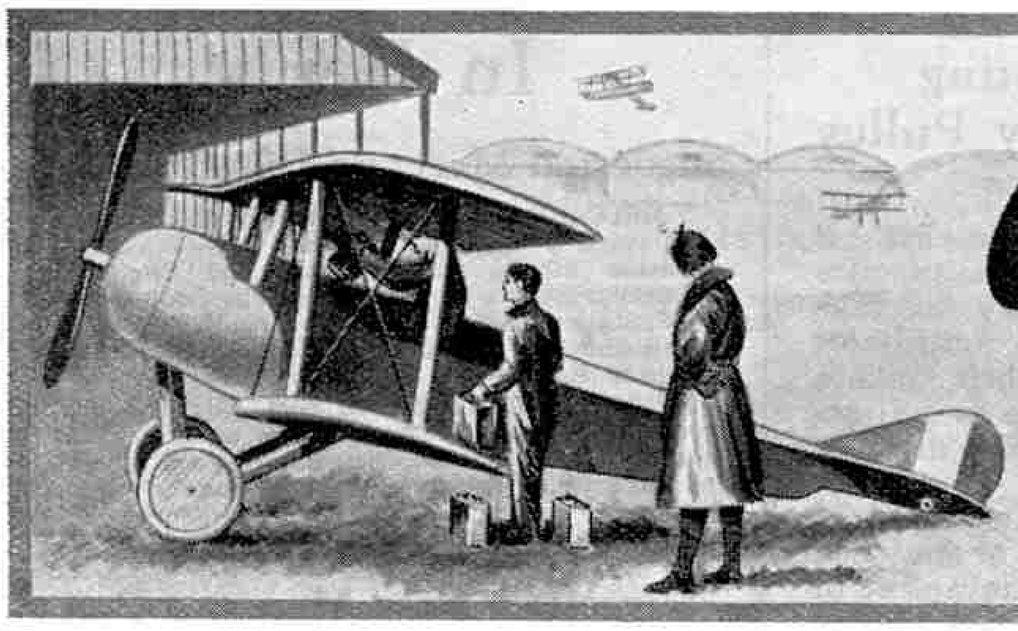
PISTON CONNECTION.—A piston-rod and outside cylinder attachment for Hornby Locos offers no real advantage, and several difficulties oppose its production. (*Reply to K. Yoshida, British Concession, N. China*).

HEADLAMPS FOR LOCOS.—We shall examine carefully the desirability of detachable headlamps and indicator lamps for Locos and Brake Vans. A disadvantage with such small accessories, however, exists in the fact that they can very easily be mislaid. (*Reply to E. W. White, London, N.*1.; *G. Morris, Treforest, Glam.; Robert W. Rush, Accrington; J. Mitchell, Hipperholme; F. C. Brown, Northwood; R. M. Bentley, West Kirby, and others*).

VACUUM BRAKE PIPES.—The addition of miniature piping in Hornby Locos to represent vacuum brake connections would certainly be ornamental, but would serve no useful purpose. (*Reply to R. M. Bentley, West Kirby, Cheshire; H. C. H. Kerr, London, N.*3; *J. Mitchell, Hipperholme; and others*).

"NEUTRAL" GEAR FOR LOCOS.—We do not consider that the advantages accruing from a "neutral" position in the drive of Hornby Locos would be sufficient to warrant the expense of its addition. The occasions on which a Hornby Loco is required to "free-wheel" are very few. (*Reply to J. J. Hemmons, Bassein, Burma, and K. D. M. Bowron, Paignton*).

CLOCKWORK LORRIES.—Clockwork lorries and model milk carts as station accessories would be outside our usual practice; such models may easily be made with Meccano. (*Reply to B. Morris, Treforest*).



Air News of the Month

Aeroplane as Disinfector

American farmers do not hesitate to adopt new methods in order to obtain more satisfactory results. Disinfecting crops by means of insect killing dust sprayed from aeroplanes is the latest "stunt." This idea was first used in the cotton fields but in the spring of this year it was carried out with great success over a peach orchard consisting of more than 10,000 trees. The "dust" consisted of hydrated lime and arsenated lead and the whole process was completed in just under two hours, this time including landings for fresh supplies of disinfectant.

* * * *

Interesting New Type of Flying Machine

In appearance somewhat like a windmill, but with horizontal sails, a machine that is probably the strangest flying machine ever invented has reached this country from Spain, to undergo Air Ministry trials. The 'plane is the result of considerable research by Don Juan de la Cierva, who has thirty-three previous aeroplanes to his building record. It embodies an attempt to combine the principal properties of the helicopter, the ordinary monoplane and the ornithopter, so called because it flaps its wings in imitation of a bird. This "flying windmill" has already undergone extensive tests in Madrid, and a prominent British pilot has stated that it possesses big possibilities. (Full description on page 48).

* * * *

Aerial Scouting

The Eastman Kodak Research Laboratories issue details of a remarkable development in aerial photography that will increase both the value and speed of the camera scout under the conditions of modern warfare. Dr. C. E. Kenneth Mees, the eminent photographic research worker, has evolved a reversible film, known technically as "Ana-positive." The film has now been tested by officers of the United States Army Air Service and Dr. Burka, a scientist employed by the U.S. Government.

The striking feature of the film is that it exhibits, after development, a negative image when viewed by transmitted light and a positive when seen by reflected light. Thus for immediate use in wartime a positive picture is available and ordinary prints may be made later. Apparatus for developing, fixing and washing is provided in the observer's compartment of the aeroplane and the drying of the film is also completed while the machine is in the air.

It is claimed that, using this film, the air scout of the future will not be obliged to return to his headquarters before his exposed plates and films will be of use, but the new film will enable photographs of enemy positions to be taken, completed and dropped at pre-arranged points, leaving the airman free to carry on his reconnoitring without landing.

Our readers will understand the idea of this film better if they will examine any badly under-exposed negative they may possess. When viewed from certain angles by light reflected from the surface, a positive can be seen. Only the negative image is seen when the film is viewed by being placed between the eye and the source of the light, i.e., by transmitted light. It must not be inferred, however, that the reversed image of Dr. Mees' film is obtained in the same way. The process is of course secret and under-exposed negatives have no place in the aerial photographer's scheme of things.

* * * *

Aero-Insurance

The International Air Congress, which met recently at Lyons, discussed many points of legal interest to aviation in its commercial aspect. The question of compulsory insurance of passengers by the carrying companies came under review, but was voted against. The position remains that the passenger must effect his own insurance—the risk from air travel is fast becoming a normal risk—if he specially desires so to do.

The Congress decided, however, that the personnel engaged on the machine should be insured compulsorily, save in those countries where the laws provide for compensation for injury arising out of employment.

* * * *

The "Postal" Napier-Bodmin

This new all-metal machine, which underwent its trial flights in August, will probably be the first machine for use on the proposed Karachi-Kantara mail route. The machine is an entirely new design as the two 450 h.p. Napier engines are placed in an engine room situated in the fuselage, each engine driving a propeller on either side of the fuselage through gears. The twelve cylinders are fitted on the broad arrow principle, in three rows of four, the weight per horse power developed of each engine being slightly less than 2 lbs.

Should one engine fail, the other will be able to maintain the aeroplane in flight.

Intended for mail and passenger carrying the 'plane, which is to be known as the "Postal" type, can be quickly converted for use as a bombing machine for military purposes. * * * *

Night Flying

Last year several experiments were conducted at Croydon Aerodrome with the object of increasing and improving the landing arrangements for night flying. Further official experiments are shortly to be made to improve upon the present arrangements, which include two series of red neon tube lights mounted on towers and several stationary and flashing lights. The neon lights have displayed excellent fog-piercing properties and it is proposed to lay lines of similar lights across the aerodrome.

A further interesting improvement will be the electric ring cable that is to be laid around the boundary of the aerodrome. Signals radiated from the cable will affect a special instrument mounted in the 'plane, and the pilot will be enabled to verify his height above the ground from moment to moment. These electric signals will indicate the machine's position in relation to the landing ground, so that even in mist or fog it can glide down continuously until the aerodrome lights are clearly visible.

* * * *

Aircraft Inspection

The importance of the Commercial Air Industry is reflected in a statistical table given elsewhere in these notes and it is therefore not altogether surprising to learn that the Bureau Veritas, a French Association corresponding with the British Association of underwriters known as Lloyds, has decided to include aircraft within the scope of its operations.

As is well known, both Lloyds and Bureau Veritas have been in existence for over a hundred years, rendering incalculable service to maritime interests particularly and commerce generally. Their operations consist of registering the details of all new ships, classifying and keeping track of them and making periodical inspections for the purpose of certifying their state of fitness for sea. So great is their authority that no company will insure an uncertified ship and the shipping authorities would decline to permit such a vessel to carry passengers.

This brief review of the functions performed by the two associations will enable our readers to grasp the importance of the first Aeronautical Register issued by the Bureau Veritas for the year 1925. In this register are entered the details of the civil aircraft inspected, together with general information of importance to aviators. A certificate of fitness for flight is issued in respect of all machines and airships registered, and each will be required to undergo periodical inspection.

The institution of this inspection marks an important forward step in commercial aviation and should prove of vast importance both to passengers and insurance companies.

Dutch 'Planes and British Engines

With the exception of four Fokker III. monoplanes, which are to be held in reserve, the whole of the machines owned by one of the most important lines in Holland are to be offered for sale. The new machines ordered for replacement purposes are Fokker VII. passenger aeroplanes, all of which will be equipped with British Jupiter 400 h.p. air-cooled engines.

* * *

Propellerless Aeroplane

An aeroplane that will dispense with propellers and rely for its motive power upon the discharge of highly compressed gas is in course of construction by a French inventor. Briefly stated, propulsion is effected by a powerful charge of gas, generated in a specially devised chamber and passed through a compressor. It will be emitted through three nozzles at the rear of the machine with such force as to send the machine forward. It is claimed that speeds of 380 m.p.h. will be possible, as compared with the maximum of 300 m.p.h. forecasted for the latest racing machine of the orthodox type.

* * * *

Indian Airship Shed

The Armstrong Construction Company, a subsidiary of Messrs. Armstrong Whitworth Co., is commencing a contract for the erection of a new airship shed on a site near to the present station of the Royal Air Force at Karachi. The shed is intended to be the terminal station for the proposed England-India Air Service.

The Karachi shed will be one of the largest structures in the world, being 850 ft. in length and 180 ft. in width, with a total height of nearly 200 ft. For the purpose of comparison it is interesting to note that the shed will be twice the length of the Crystal Palace and considerably higher and wider. The Cardington airship shed, at present the largest building of the kind, is 40 ft. shorter and about 15 ft. less in height.

* * * *

Rescued by Air

Two French commercial aeroplanes recently were instrumental in saving the lives of the crew of a Bordeaux tug who had been cast ashore on the West African Coast and were in danger of attack by turbulent natives. Part of the crew had been picked up by a passing schooner, but four had been left behind and were surrounded by hostile Moors. The two pilots landed near the scene of the attack and each succeeded in rescuing two of the men.

An Aerial Stowaway

A Los Angeles report states that the first instance of an aerial stowaway was recorded there recently, when a boy attempted to steal a ride by clutching the wings of an aeroplane as it started up. The boy was carried several miles before he was noticed by the occupants, in endeavouring to trace the cause of the machine's continual deviation from an even keel. He was motioned to work his way along the wing to the fuselage and finally hauled aboard.

* * *

More Records

A new world's record for seaplanes has been established by Lieut. J. H. Doolittle of the American Army Air Service over the 3 kilometres course at Bay Shore Park, while flying the Curtiss Racer with which he won the Schneider Cup Race. The speed attained was 245.713 m.p.h., which is 17 m.p.h. faster than the record set up by Supermarine-Napier S.4.

* * * *

Light Aeroplane Costs

The results of the first few months' flying by the light aeroplane clubs show that the cost of upkeep is very little more than that of the average motor car. Altogether 7,000 miles have been flown for instructional purposes, including approximately 1,200 landings, and replacement costs have been practically non-existent.

* * * *

Aviation in Australia

Australian aviation continues to develop speedily and new commercial routes are being mapped out. With these in operation there will be 53 aerodromes and 85 emergency service landing stations dotted up and down 4,700 miles of recognised flying routes. The most important of these routes is that maintained by Western Australian Airways Ltd., between Perth and Derby, a distance of approximately 700 miles, over which a weekly service is maintained.

Duration Trials

Experiments are in progress in America to investigate the possibility of relieving the fatigued pilot and mechanic of a machine and replacing them by a fresh crew while in the air. The transfer from one machine to another will be made by means of a flexible wind-shielded ladder, the two machines meanwhile flying at the lowest possible speed.

Tests are also being carried out to ascertain how long an aeroplane can remain in flight provided that its fuel tanks are replenished from another machine. In early experiments a big army biplane was refueled fifteen times by aircraft flying immediately overhead and feeding it through flexible tubes.

* * *

Submarine Hangar

A marvellous little seaplane that can be folded up and stored in a submarine has recently passed trials at St. Raphael. The machine is fitted with a 40 h.p. Radial engine and carries a small wireless set with which it can be in constant communication with its parent ship while in flight. Its chief duty in war would be scouting when the submarine was operating at a distance from its base and, if necessary, it would be able to attack hostile craft. At the completion of its flight the machine alights on the water alongside the submarine and is lifted on board, folded and stowed away in a small water-tight compartment below deck.

Aircraft manufacturers in this and other countries have been attempting to produce an efficient submarine-carried aeroplane but, owing to Air Ministry restrictions, very little is known of British progress.

The Air Ministry's "Hush Hush" policy is the cause of a neat joke going the rounds. An inventor of a tailless 'plane presented it for the Ministry's inspection. Now it's a "tale"-less 'plane!

* * * *

Body-less Aeroplane

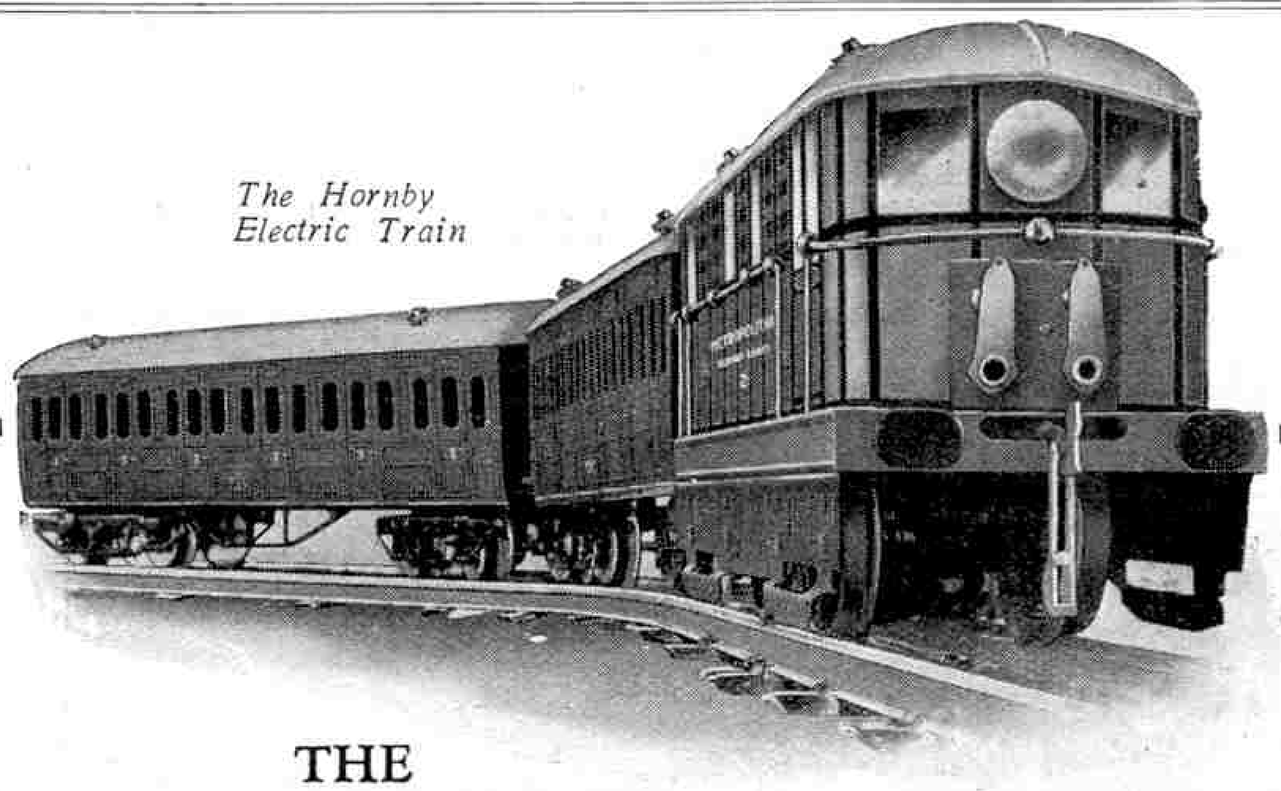
A young engineer named De Monge is the inventor of a body-less aeroplane that was successfully tried out at Villacoublay recently. Except for the forepart in which the engines are located, and to which sections of the single wing are attached, the machine has no body, the tail being connected to the motors and wings by two light metal "girders." The machine is driven by two 9 h.p. engines, which propel it at a speed of approximately 90 m.p.h., the petrol consumption being roughly one gallon per 25 miles. The inventor is designing a 20-passenger machine embodying the same principles in which he hopes to cross the Atlantic.

World's Largest Aeroplane



Photo courtesy] [*Messrs. Vickers Aviation Dept.*

The Vickers Rolls-Royce "Vanguard," recently handed over for service with Imperial Airways, is the largest passenger-carrying aeroplane in the world. We hope to fully describe this wonderful machine in the near future.



The Hornby Electric Train

What fun it is to sit by the regulator and with a touch of the finger send this superb model electric train gliding along the track—to stop it—to start it up gradually—to watch it accelerate !

THE

HORNBY ELECTRIC TRAIN

The Latest Hornby Thrill

THE Hornby Electric Train is modelled from the rolling-stock of the Metropolitan Railway, and is most realistic in appearance. Both Loco and Coaches are fitted with electric lights, which may be switched on and off at will. The finish and workmanship are of the highest quality.

Any boy can fit up the track and operate the train. It is designed to run from the ordinary town current of 100 to 240 volts, either alternating or direct. It is connected to the house supply by inserting the adapter, which is included in the set, to the nearest lamp socket. The current is converted to the correct pressure through a 60-watt lamp of the same voltage as the supply. (The lamp is not included in the set. Everything else necessary is provided) Full instructions accompany each set, and there are no difficulties or dangers.

Loco, Coaches and rails are fully covered by our usual guarantee.

2. THE LOCOMOTIVE

The Hornby Electric Locomotive is an exceptionally powerful model, and will start on, and climb a steep gradient. It measures 9¾" in length from buffer to buffer, and weighs 1 lb. 14 ozs. The motor is the most efficient ever fitted to a model loco. The field winding is 150 yards in length and consists of D.S. Covered wire, which eliminates any possibility of insulation breakdown.

We illustrate below the 4-wheeled motor bogie. The collecting shoes (1), wheel flanges (2), and rails should be kept clean and free from oil, to ensure good contact. The axles (3), gear bearings (4), and both ends of the armature shaft (5) should be lubricated with a little light oil, but not too freely.

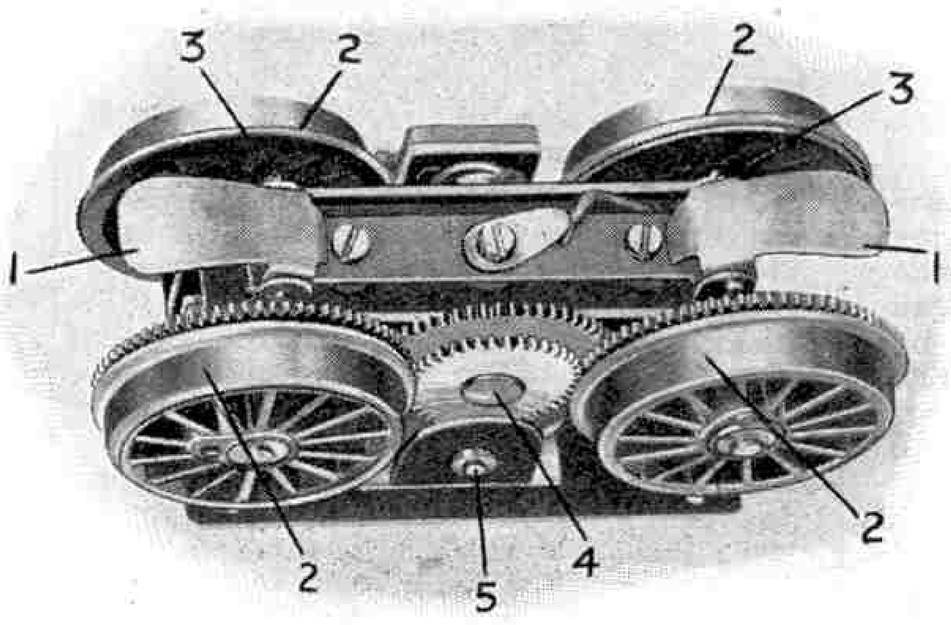
THE SET contains Electric Loco, two Metropolitan Passenger Coaches, and Electric Rails to form a circle 4 ft. in diameter, together with a rheostat, with adapter and length of flex, and rail terminal plate. The Loco is fitted with reversing gear.

Complete set, in strong box .. Price £5/10/-

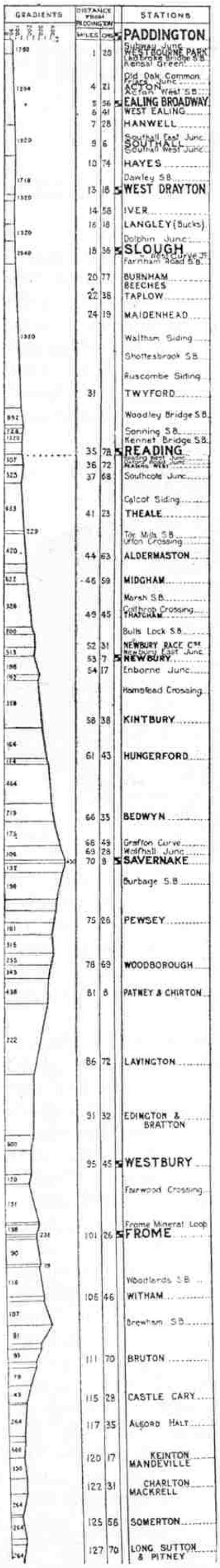
Hornby Electric Loco .. .. Price 52/6 Hornby Coach, Metropolitan .. Price 18/-

Rheostat, with adapter and length of flex, Price 16/-

FROM ALL MECCANO DEALERS.



MECCANO LTD. LIVERPOOL



More Mountainous than St. Gothard

Railway Gradients Mean Beautiful Scenery

LOOKING out of the window as the train speeds onward, the alert traveller will notice at intervals along the line, diminutive sign posts, with the finger boards tilted at various angles. Occasionally one of the finger-boards will be fixed to the post horizontally with the word "Level" painted upon it. This gives the clue to their use for the board indicates that the line in that direction is level. More often than not, however, the figures "1 in" followed by some number show a rise or fall in the road according to whether the finger board is inclined upward or downward. The frequency with which these boards are passed soon conveys the impression that a railway is actually far from level.

Steep Gradients mean High Operating Costs

In this connection it is interesting to note that some of the steepest grades in the country are to be found on the G.W.R. Main Line between Newton Abbot and Plymouth, where the line is actually more "mountainous" than that passed over on the St. Gothard Route to Switzerland.

Now, steep gradients cut both ways. From the traveller's point of view they invariably mean fine scenery, which is particularly true of South Devon, but the Railway Company would far rather do without them, as they also mean high operating costs. Thus at Newton Abbot, Totnes and Plymouth, extra locomotives, drivers and firemen have to be employed specially for assisting many trains up Dainton, Rattery and Hemerdon inclines. On reaching the summit, since no useful work can be found for them to do, these extra locos have to return "light" to the foot of the incline.

At the top of these steep inclines are what are known as "Stop Boards." Here all freight trains not fitted with automatic brakes have to stop dead before making the descent in order that the guard may apply hand brakes on the vehicles to prevent the train getting out of control and running away down the bank.

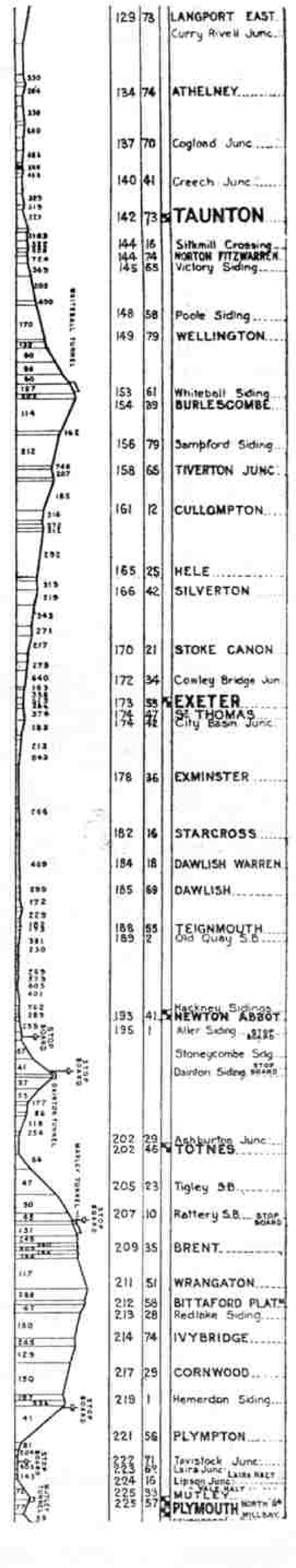
Steepest Main Line Gradient in Britain

While the steepest gradient to be found on any main line in this country is an inch in the yard, which would read on the gradient finger board "1 in 36," (equal to a vertical rise of one foot in little over half the length of an average passenger coach), on Goods lines, considerably steeper grades are to be found. Thus at Newquay (Cornwall) on the line between the passenger station and the harbour there is a gradient as steep as 1 in $4\frac{1}{2}$ up which goods trains are hauled by a rope operated by a winding engine. Here again the gradient is necessary owing to the magnificent range of cliffs on which Newquay is situated and from which a fine view is obtained of the Harbour and beaches down below. Steep gradients mean fine scenery every time!

Stephenson did not Favour Gradients

It is interesting to know that George Stephenson refused to lay out any inclines, to be worked by locomotives, steeper than 1 in 330. All through his career his practice was to secure a road as nearly level as possible, following the course of the valleys and natural line of the country, and preferring always to go round a hill rather than tunnel under it or take his railway over it.

Stephenson never forgot that it was necessary that the railways he constructed should be successful from a financial as well as from an engineering point of view, and he endeavoured to lay out his track so that trains might be hauled along with the least possible expenditure of locomotive power. Frequently he made quite considerable detours in order to secure workable gradients, for he saw clearly that a longer but level line must be economically superior to a shorter line with steep gradients.

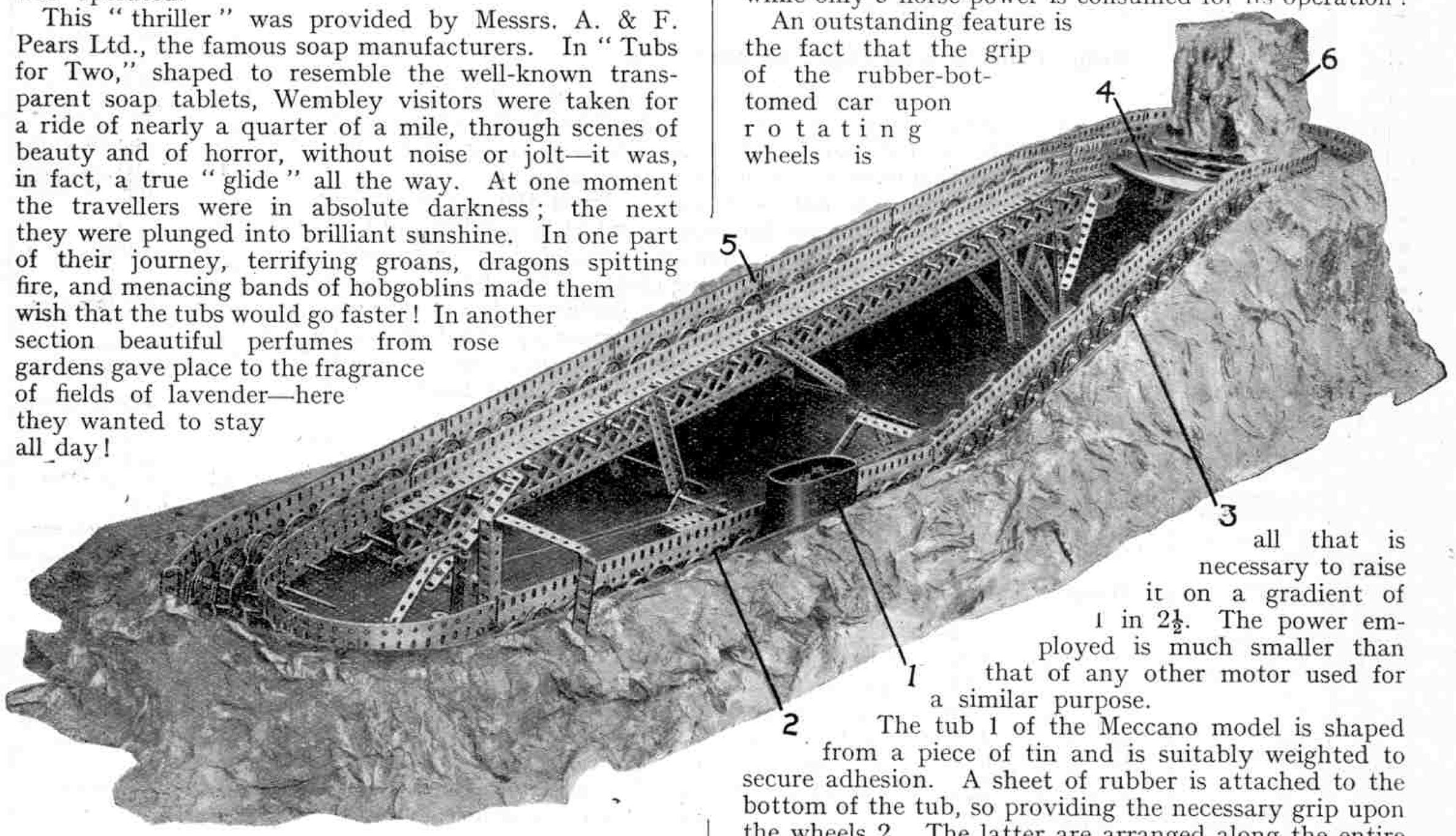


Meccano Assists another Inventor

How Messrs. Pears' "Golden Glide" was Designed

MANY of our readers who visited Wembley Amusement Park during the second year of the great Empire Exhibition probably experienced some delightful thrills on the "Golden Glide." Those readers will be specially interested, we believe, to read of the part played by Meccano in the invention of the unique mechanism by which the wonderful joy-ride was operated.

This "thriller" was provided by Messrs. A. & F. Pears Ltd., the famous soap manufacturers. In "Tubs for Two," shaped to resemble the well-known transparent soap tablets, Wembley visitors were taken for a ride of nearly a quarter of a mile, through scenes of beauty and of horror, without noise or jolt—it was, in fact, a true "glide" all the way. At one moment the travellers were in absolute darkness; the next they were plunged into brilliant sunshine. In one part of their journey, terrifying groans, dragons spitting fire, and menacing bands of hobgoblins made them wish that the tubs would go faster! In another section beautiful perfumes from rose gardens gave place to the fragrance of fields of lavender—here they wanted to stay all day!



The Original Meccano Model of the "Golden Glide"

More than once in this glorious glide it appeared that nothing could prevent a terrible disaster. As the "Tubs for Two" slid silently and swiftly on their way, brick walls suddenly confronted the passengers; a hasty prayer was breathed, one last look at life and sunshine and—the "walls" opened to a new scene!

Throughout the journey there was something of interest to engage attention. The pace varied from a slow glide to a swift downward rush. In one place the gradient was actually a one foot rise in 2½ feet, but the "Tubs" surmounted all difficulties with the greatest ease and safety.

Only 9 Horse-Power Required

The "Golden Glide," which has been described as a triumph of engineering, was designed by Mr. C. E. Cannon, Messrs. Pears' Publicity Manager. In an interview, Mr. Cannon informed our representative that the original model of the apparatus was worked out entirely with Meccano, and its ingenuity and simplicity is well shown in the photograph of the model reproduced on this page. The actual machine is capable of carrying a load of 40 stones in each tub at a speed of 15 miles per hour, while only 9 horse-power is consumed for its operation!

An outstanding feature is the fact that the grip of the rubber-bottomed car upon rotating wheels is all that is necessary to raise it on a gradient of 1 in 2½. The power employed is much smaller than that of any other motor used for a similar purpose.

The tub 1 of the Meccano model is shaped from a piece of tin and is suitably weighted to secure adhesion. A sheet of rubber is attached to the bottom of the tub, so providing the necessary grip upon the wheels 2. The latter are arranged along the entire length of the run, but only those placed in the level stretch 2 and on the incline 3 are driven from the Motor. The tub commences its journey on the level at 2 and is carried by the rotating wheels up the incline 3, from which it is deposited upon a slowly revolving turntable 4. This turntable is dispensed with in the actual machine since it has been found that the same result could be obtained by continuing the wheels round a more gradual curve. The turntable brings the tub to the head of the opposite incline 5, down which it is propelled by the force of gravity. The driven wheels at 2 and 3 are coupled to the Motor through a series of Sprocket Chains. A vertical column, carrying the turntable 4 and scenery 6, is also rotated from the Motor, which is situated within the model. It will be noted that the whole structure is covered with crinkled paper, brightly painted to represent scenic effects.

(*Continued on page* 53)

OUR BUSY INVENTORS

RECENT INTERESTING PATENTS

Shipping Exhibition Novelties

Some wonderful inventions were to be seen at the recent Shipping, Engineering and Machinery Exhibition, at Olympia. The Exhibition afforded a comprehensive display of the latest inventions and developments in almost every type of marine engine and machinery. There were, for instance, demonstrations of the most modern scientific methods of cutting, shaping, bending, punching, and welding metals. Launching lifeboats in a storm. Fighting fire at sea. Spraying the hulls of ships with preservative paint. Deep sea divers at work. Practical lessons in ocean wireless, in life-saving, and in the operation of pneumatic tools. A new elevator that lifts 12,000 gallons of water an hour from a deep well to a height of 40 ft.

Model craft floating on a tank of water demonstrated how a newly-invented reversing-rudder makes simple the manœuvring of boats of any size. At another stand visitors were shown how automatic steering is effected and how a ship rolling in a heavy sea is steadied by means of a gyroscopic stabiliser. There was also an extensive display of the latest types of motor-boats, ranging from canoes to auxilliary power yachts and hydroplanes.

One of the most popular exhibits was a model of the bridge of an Atlantic liner, where visitors were able to take charge, and imagine themselves in control of the vessel.

Altogether the Exhibition was a triumph of modern invention and many of the devices shown were certainly the recent work of "our busy inventors."

* * * *

The Human Telephone

Inventors are becoming so resourceful in these days that soon it will be possible for the whole of the world's work to be done entirely by machinery. An addition to the link of ingenious appliances is a machine called the telegraphone, which machine answers the telephone by itself! If a business man has to leave his office he dictates a statement to the telegraphone saying when he will be back and asking callers to dictate their message. Every incoming call is automatically switched through to the telegraphone, which repeats to the caller the message left by the business man. The caller then dictates his message and rings off, automatically disconnecting the telegraphone, the process being repeated with subsequent callers. When the owner returns he simply picks up the headphones of the telegraphone and hears all the recorded messages in the actual voices of the callers.

The machine can be operated in conjunction with a wax recording cylinder and used for reproduction purposes in precisely the same way as a gramophone record.

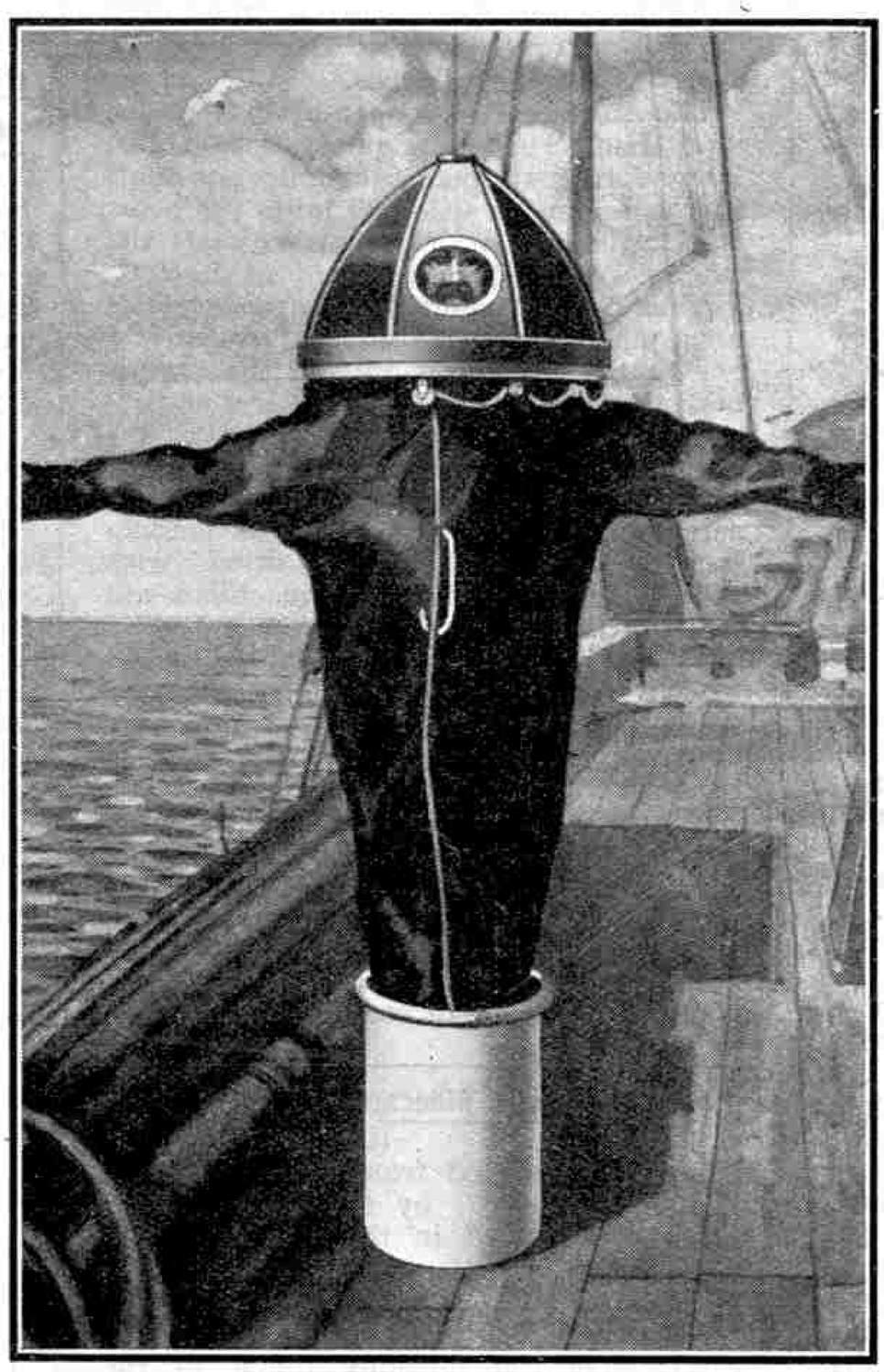
Wanted Inventions

The War Office is endeavouring to bring the Army Mechanical departments to a higher state of efficiency and a list of "wants" has been issued in the hope that inventors will submit ideas. Most of the inventions wanted are of a highly technical nature, but a few are classified as "general," principal among these being: A secret wireless telegraph. Transmission of speech by light. A light, pliable, fairly strong, translucent substitute for glass. A bullet-proof pneumatic tyre, unaffected by extremes of either heat or cold.

* * * *

For Saving Life at Sea

Experiments with a new life-saving suit are now being carried out in the North Sea. The suit is so constructed that the person inside it can float in the water, withdraw inside the apparatus, or in case of necessity, fire through the sight opening with a Verey pistol attached to the suit. In addition, provision is made for the storing, in the suit, of a supply of food. The accompanying illustration shows the apparatus fitted ready for trial, with a man inside.



The New Life-Saving Suit described below

Ingenious Deep-Sea Diving Apparatus

The recent regrettable disaster to submarine M.1 has raised again the question of submarine safety signals and devices for escaping from sunken submarines.

Commander Kenworthy, M.P., speaking recently on the matter, said there should be a very elaborate system of safety devices arranged for locating a submarine out of control. He pointed out that there do not appear to be any technical difficulties in the way of a buoy attached to the submarine, being released, to float to the surface in case of accident, and carry a smoke signal that would mark the position in the daytime, even in a rough sea. The position at night would be marked by a flare, both smoke and flare originating in the action of calcium carbide, which gives off an inflammable gas on contact with water. The buoy could also have a telephone to communicate from the surface of the interior of the sunken submarine. Commander Kenworthy claims that it is not beyond the resources of science to communicate by wireless from a sunken submarine even when lying on the bed of the ocean.

In connection with the M.1 disaster an ingenious deep-sea diving apparatus was brought over from Germany in a final attempt to discover the resting place of the ill-fated vessel. The apparatus was in charge of Herr Kucharski, chief engineer of the expedition, who with Kerr Gutmacher—the managing director of Newfeldt and Kuhnk, owners of the special apparatus—brought a crew of eight men, including five expert divers.

The special diving apparatus consists of what is virtually a suit of deep-sea armour of steel or aluminium alloy, which resists the high pressure of the water at a great depth. The body is joined at the hips, and is constructed of forged steel. The diver is lowered by means of a special cable from a crane or winch, the cable containing several supporting wires so that the diver can communicate with the ship. The diver also has an instrument to inform him of his depth, and carries an air supply sufficient for four or five hours. The air inside the armour is purified by a chemical, and additional oxygen is obtained from the cylinders.

Into the arm coverings are inserted various devices by which the diver can perform such work as placing a bolt in position or boring a hole in a ship's plate. The jointed legs enable him to walk about, lie down, and perform every movement necessary in connection with the operations in which he is engaged.

For observational purposes several windows are provided in the armour, and illumination is provided by high-power lamps. The suit is a bulky, quaintly-designed construction, weighing from 450 to 650 lbs. and its cost runs into several thousand pounds.

Waterloo Bridge—(*cont. from page* 27)

supported by six brick walls 2 ft. 3 in. thick, covered with corbel stones. It was formed by a layer of puddled clay 15 in. thick, then a layer of lime and fine gravel 3 in. thick followed by a layer of granite, broken in pieces 2 in. in diameter, 1 ft. thick. The roadway for carriages is 28 ft. wide and the footpaths on each side 7 ft. wide.

Through the centre of the masonry of each pier a hole 18 in. in diameter was cut, entering the river at one side of the pier at low water, and from the top of this hole inside the pier pipes were carried to drains on each side of the roadway, thus effectually carrying away all rain and surface water into the river.

An Ingenious Expedient

The engineer Dodds had proposed to found the piers of his bridge by means of caissons, but Rennie decided upon the use of cofferdams. A cofferdam may be described as consisting of two concentric rings of piles driven in contact with one another around the area on which the foundation is to be built. The space between the two rings of piles is tightly packed with clay so as to make the enclosure watertight, and the water inside is pumped out. Excavation to the proper depth is then made, the foundation is laid, and building operations proceed until the pier has reached a height above the level of the outside water. At this stage the cofferdam has served its purpose and is then removed.

The method employed by Rennie for constructing, floating and fixing the centres for the arches was very ingenious. Each centre consisted of eight ribs on the truss principle, resting upon wedges supported upon struts placed upon the offsets of the piers and abutments. All the ribs were connected together by transverse and diagonal ties as well as planking upon which the arch-stones rested.

The centres were constructed on a platform by the riverside, floated between the piers on barges specially built for the purpose, and raised into their proper places by means of four powerful screws fixed in cast iron boxes firmly bedded in the solid floor of the barge. The scheme proved so successful that the fixing of one centre was usually completed within a week. This method was new at the time and it is interesting to note that it was the same as that afterwards followed by Robert Stephenson in fixing the great tubes of the Conway and Britannia Bridges.

A Knighthood Declined

The bridge and its approaches were completed and opened with great ceremony in June 1817 by George IV., then Prince Regent, who was accompanied by the Duke of Wellington. It was originally named the Strand Bridge, but the name was subsequently altered to Waterloo in commemoration of the Battle of Waterloo and in honour of the Duke.

At the opening ceremony the Prince Regent offered to confer the honour of knighthood upon Rennie, who respectfully declined it. Writing afterwards to a friend he said: "I had a hard business to escape knighthood at the ceremony." He preferred to remain simply John Rennie, engineer of the noble structure he had successfully brought to completion.

The Conquest of the Air—

(*Continued from page* 55)

aeroplane's wings. When in the air, the machine is controlled by the elevator and steered by the rudder in the ordinary manner.

The chief advantages of the Auto-giro are that in addition to being able to fly at a comparatively high speed, climbing and gliding in the usual manner, it is also able to fly at very low speeds and to descend almost vertically under complete control. The fact that it can fly at such low speeds makes the type valuable for observation purposes, for with the ordinary aeroplane, which must be kept on the move, it is often very difficult for a detailed observation of any particular feature to be made, unless the aeroplane circles over the spot or travels backwards and forwards over it a number of times.

The Auto-giro has a span of 36 ft. and a total weight, including pilot, of 2,000 lbs. Its maximum air speed is 68 miles per hour, and its minimum speed 30 miles per hour. It is claimed that in its earlier tests the machine climbed to a height of 1,150 ft. This is indeed a creditable performance for a machine of such unusual design and one that is obviously only in the experimental stages.

The designer of the Auto-giro claims that he could build a machine that would attain a higher speed than any existing aeroplane and yet retain a low landing speed. He suggests that fitted with 450 h.p. engines, his future machines will certainly attain a speed of over 300 miles per hour, and that such machines would have a landing speed of under 40 miles an hour. On the other hand, at a sacrifice of speed, Auto-giros can be built to carry big loads.

Whether these anticipations can be realised or not remains to be seen, but it is a fact that the Auto-giro has caused considerable interest among experts and has proved that there is a decided possibility in machines of the helicopter type, a point that has long been denied by some experts.

Motor-Cycle and Sidecar—

(*Continued from page* 13)

pillion (constructed from two short Flat Girders "sprung" by a method similar to that employed in the saddle) and a rear stand, for attachment if the model is used as a solo outfit. Still further refinements, such as number-plates, etc., would give the finishing touch to the compact and realistic appearance of the model.

PARTS REQUIRED:—

Motor Cycle

2 of No. 2	1 of No. 18B	1 of No. 96
2 „ „ 3	2 „ „ 19B	1 „ „ 96A
1 „ „ 4	1 „ „ 22	1 „ „ 101
10 „ „ 5	1 „ „ 23A	2 „ „ 103G
1 „ „ 6A	2 „ „ 32	3 „ „ 111
2 „ „ 10	28 „ „ 37	3 „ „ 111A
6 „ „ 11	10 „ „ 37A	2 „ „ 115
4 „ „ 12	16 „ „ 38	1 „ „ 116
1 „ „ 15	11 „ „ 59	3 „ „ 120A
1 „ „ 15A	8 „ „ 63	2 „ „ 126A
1 „ „ 16	3 „ „ 77	2 „ „ 142
5 „ „ 17	2 „ „ 90	Small elastic band
4 „ „ 18A	6½ „ „ 94	

Sidecar

2 of No. 2	1 of No. 17	1 of No. 64
2 „ „ 2A	1 „ „ 18A	6 „ „ 89
5 „ „ 3	1 „ „ 19	8 „ „ 90
5 „ „ 5	1 „ „ 19B	2 „ „ 103F
2 „ „ 6A	55 „ „ 37	2 „ „ 103H
1 „ „ 9F	1 „ „ 37A	1 „ „ 111A
1 „ „ 10	3 „ „ 38	1 „ „ 125
2 „ „ 11	2 „ „ 43	2 „ „ 133
3 „ „ 12	7 „ „ 48A	1 „ „ 142
2 „ „ 16	4 „ „ 59	
1 „ „ 16A	5 „ „ 63	

My Clockwork Train

Sometimes on rainy Saturdays,
I can't go out to play,
And so I take my clockwork train,
And travel miles away.

I start at Bookcase Corner,
And go to Plymouth Sound;
And via Table Tunnel,
I travel round and round.

Sometimes I have an accident,
My train falls off the rail;
I have to send the breakdown gang,
I know it cannot fail.

I sometimes have excursion trains
To Wembley once I went;
And I have football specials too,
And mails with me are sent.

I take my sister's little dolls,
And ride them round the track,
And when they've had their money's worth,
I bring them safely back.

Although I've lots of other toys,
I still come back again,
And many happy hours I spend
With my "Hornby Clockwork train."

(By Master Wilfred Ashworth, of Parton, Cumberland).

Meccano Assists Inventor—(*cont. from page* 50)

An escalator based upon Mr. Cannon's patent is to be installed in the White City Exhibition for 1927, and a similar transport system is already employed in three or four factories in this country, where it forms an economical method of conveying goods. It is claimed to be the cheapest form of transport known.

At the White City it will be possible to maintain in continuous motion any number of cars up to 30; this would give the machine a maximum capacity of 2,000 passengers per hour. It is also claimed that this method of transport is quite safe, for the cars keep the same distance apart over the whole of the track, and there is no fear of some sticking and others racing.

"BETA" PENS

BRITISH THROUGHOUT

THE PENS OF REAL VALUE

No. 1

EACH PEN IS A LEVER SELF-FILLER & FITTED WITH 14 Ct. GOLD NIB, IRIDIUM TIPPED.

EACH PEN IS GUARANTEED FOR 2 YEARS.

THE 5/- MODEL. "IS THE PEN FOR CONSTANT HARD WEAR."

MAKERS:

THE "BETA" PEN CO.

181, Lisburn Lane, LIVERPOOL.

No. 3

2/6 Model with patent Fixed Clip.

7/6 Model Boxed Lever.

Fun With a Hornby Train

A Letter from the "Directors" of the St. Leonard's Lodge Railway

In the course of a year we receive tens of thousands of letters from Meccano boys and from their parents. When we read the one printed below we felt at once that we should like to know the "Directors." Lincolnshire is a far cry from Liverpool, however, so we asked for a photograph. This showed three bright boys whom we are proud to number among our friends, and we feel sure our readers will be glad to see this photograph—the smiling faces seem to show that being a Director of a Hornby Railway is not really a very strenuous occupation—even when terrible accidents occur on the line!

Dear Mr. Editor,

As Chief Mechanical Engineer of the St. Leonard's Lodge Railway, I am sending you the clockwork part of one of your No. 2 Tank Locos for repair and write to say that it breaks my heart to part with it. I say my heart but I should really say "our" hearts, for my three directors stood with me around the writing table this morning, with drawn and set faces, and hands silently gripped in true patriotic sympathy at its departure. We consign it to the tender mercies of the specialists at the great Meccano Hospital on the advice of local practitioners and wish it a safe journey and quick return.

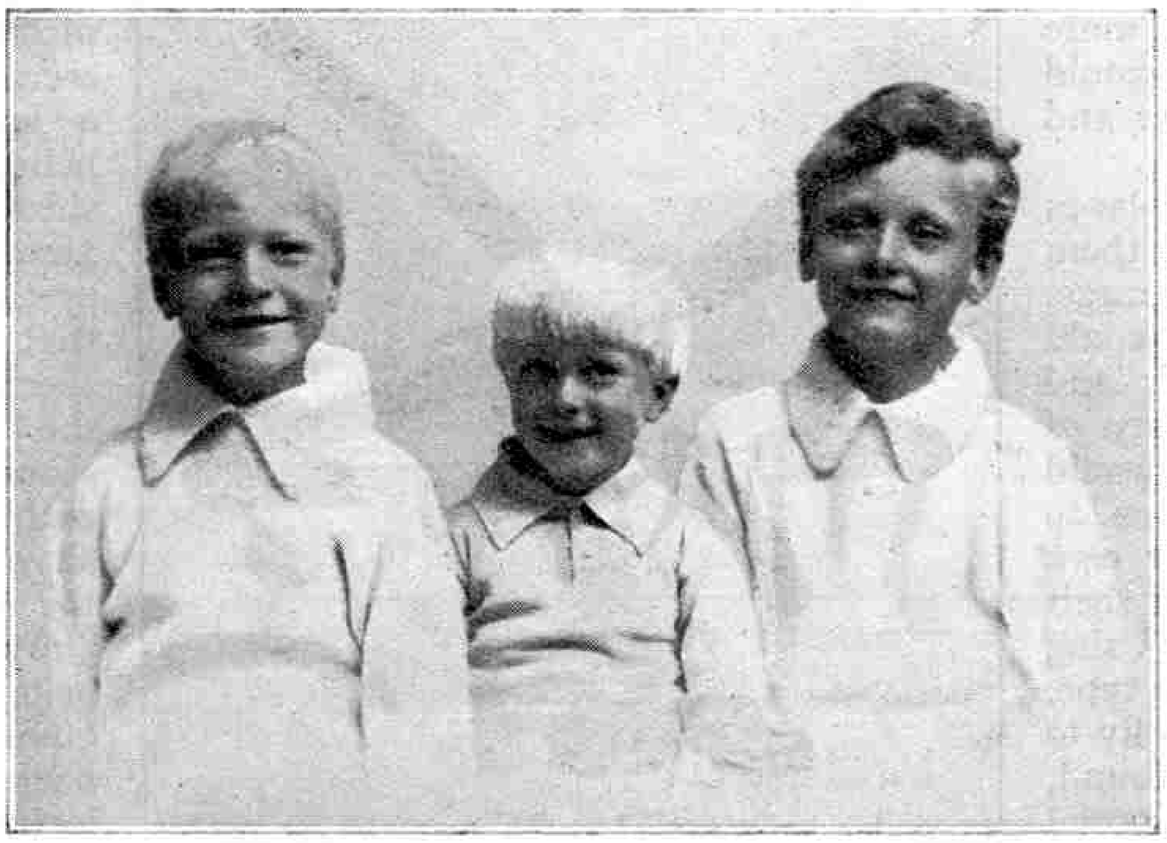
After leaving the Meccano factory, this "thing of beauty and joy for ever" first saw the light of day on Friday, 18th December at 4-10 p.m. It was promptly adopted by the writer's nephew, one Pat Johnson, age 5. Two other Hornby locos were also kindly adopted at the same time by two generous-hearted brothers of the aforesaid Pat.

On the 80 straight and 80 curved rails, together with numerous points and crossings (the whole forming its path of life) this engine has since enjoyed itself. It has at times given a helping hand on the road to its pals in distress and towed them in for minor repairs. One day recently it stopped dead, however, in the midst of a long oft-times-traversed journey from the dining room (Manchester) to the kitchen (Birmingham).

This and the absence of the block-system caused its pals to "pile up" behind in a manner too awful to describe. There was (imaginary) rending of coachwork, splintering of (imaginary) glass, shrieks of (imaginary) passengers and the track was torn up for several "miles"—in fact there was everything that goes to make a first class railway accident! Fortunately breakdown vans were lying at Leicester (branch in the sitting room) and more fortunately, a No. 2½ Tank happened to be in the sidings with steam up (wound up!) so hospital vans and breakdown gangs were at once rushed to the scene of the disaster.

After about ten minutes' steady work (such as would have put many British workmen to shame!) the track was repaired and the rolling stock replaced. Meantime, a Director's Meeting, held at Headquarters (Manchester), decided that the Insurance Company's help would not be needed and that the railway company would themselves meet all claims!

Being a Board of Trade Certified Engineer, it was only natural that I should be called upon to report on the accident—the cause and the damage. After careful examination, I decided that the Hornby must go into hospital—and be sent to Liverpool for repair. So here it is!



Peter, Pat and David, Directors of the St. Leonard's Lodge Railway

Now, Sir, the junior Director, Pat, is rapidly loosing weight all the time the engine is away, and in addition absolute chaos reigns on the "St. Leonard's Lodge Railway," for with one loco short how can the Directors possibly maintain an efficient day and night service? It is rumoured—erroneously, I must hope—that "patients" arriving at your hospital are sometimes there for weeks, but heaven forbid it should be so in this case! Please enlist the sympathy of the hundreds of human beings in your wonderful factory and let its walls vibrate and pulsate with a keen desire to restore the health of young Pat Johnson.

In conclusion, may I remark that your's must be a happy lot—to create happiness for boys. But you overstep the mark you know, because you create great interest for men also. Why don't you pack two Hornby Train Sets in every box, so that we fathers can "have a go" as well?

[*Later.*] Yesterday full services were restored on the St. Leonard's Lodge Railway after "Black Beauty"—recently returned from the great Meccano Hospital—had undergone her official tests before the Board of Directors. She showed her fitness, and proved the effectiveness of the cure, by drawing 11 fully loaded wagons from London (Dining Room) to Sheffield (Kitchen) with the greatest ease. At a subsequent Directors' Meeting I was instructed to forward you the enclosed photo as proof of the Board's fullest appreciation, satisfaction and pleasure at their ability to now restore full schedule of running and so regain the confidence of the (imaginary) general travelling public and (imaginary) traders who use the aforesaid St. Leonard's Lodge Railway.

Electricity—(*continued from page* 21)

that is surprising.

The trouble with this type of microphone has always been the fact that the carbon granules are inclined to become clogged together, with the result that the vibrations do not vary the resistance as they should. This trouble does not appear to a serious extent in modern microphones, however, so that it is improbable that any very great changes will be made in the future so far as ordinary commercial speaking telephones are concerned.

Modern Receivers

We saw that Bell's original receiver consisted of a single-pole electro-magnet, a moving armature, and a diaphragm that would follow the movement of the armature. The receivers of to-day are exactly the same in principle, although considerable mechanical improvements have been made. The single-pole electro-magnet has been replaced by a double-pole permanent magnet, so that the duty of the current through the coils of wire wound on the magnet is merely that of varying the magnetism of the magnets. The armature and the diaphragm have been combined into one unit, for the diaphragm is now a disc of extremely thin iron placed in close proximity to the poles of the magnets.

The headphones used with wireless receiving apparatus are the same as commercial receivers with the exception that the magnet-coils are wound with much finer wire, giving a higher resistance, which is more suitable for the type of currents these receivers have to pass. Loud-speaking telephones and the wireless loud-speaker are usually merely a single receiver with a larger diaphragm and a large horn, although some loud-speakers employ special means for increasing the sound.

NEXT MONTH:—

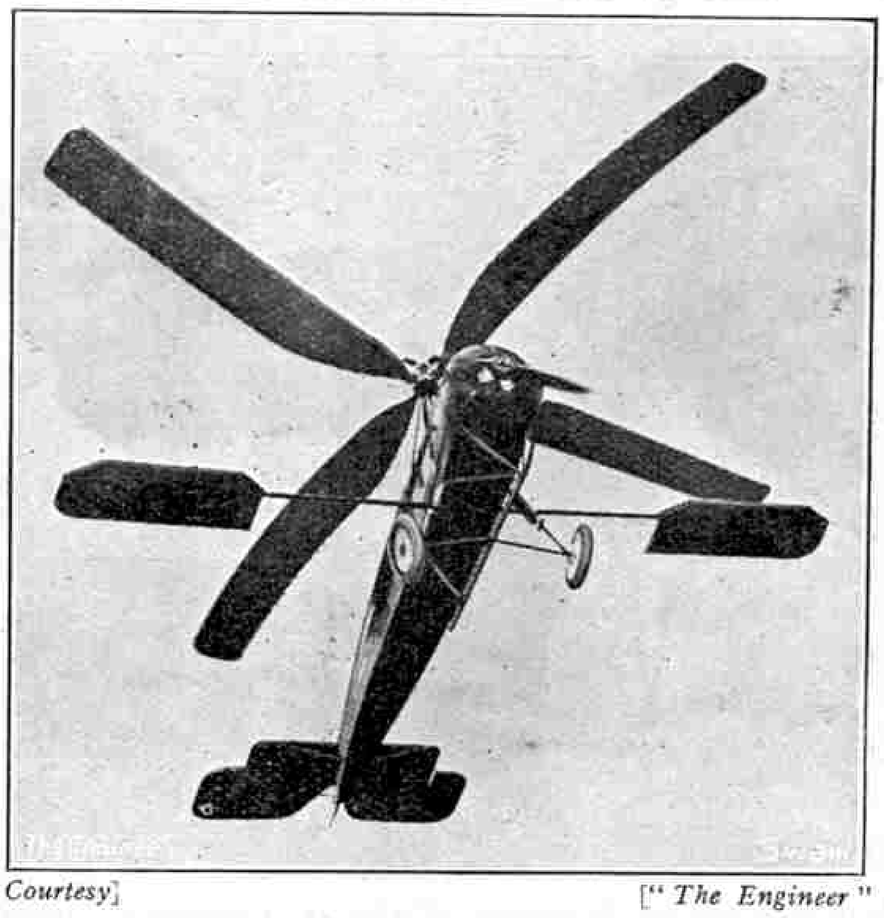
TELEPHONE EXCHANGES AND SUBSCRIBERS' SYSTEM

The Conquest of the Air

X. The Cierva Auto-giro Flying Machine

ONE of the greatest problems that has arisen in man's efforts to conquer the air, is the question of vertical flight, a satisfactory solution of which would inevitably result in considerable development in connection with flying. A machine that could rise in the air without the preliminary run now necessary, and one that could land directly on a given spot, would cause flying to become more general, and flying machines would then probably be as popular and as numerous as motor-cars.

We already have aeroplanes with folding wings to enable them to be stored in an ordinary garage. If machines of similar type could be built to rise in the air and descend without the necessity of a special landing ground, it would be possible for business men to take to the air from their own lawns, and even to alight on their office roofs in the city. Using smaller machines of a similar type, school-boys would be able to fly to school, landing in the playground, or on the playing fields! Special landing centres in our large towns and cities would be set apart for visitors who flew in from the surrounding country, and many other developments of the idea would be possible. One of the most important of these ideas, perhaps, is the possibility of such machines landing on and taking-off from the deck of a steamer or warship.



Courtesy ["*The Engineer*"

The Auto-giro in Flight

Failure of the Brennan Helicopter

Many attempts have been made with a view to solving the problem of vertical flight, but so far they have been attended with little or no success. The machines concerned are divided into two main types. These are the "Ornithopter" and the "Helicopter." The former name is derived from *ornithos* "of a bird," and *pteros* "wings." In machines of this type the wings flap up and down as in the case of a bird in flight. Although such machines have been built, none have yet actually flown. Some have moved a little way along the ground, but most of them have sooner or later flapped themselves to pieces!

The second type, the Helicopter, is perhaps the best known type of all. The name is derived from *helix* "a screw," and *pteros* "a wing" and is applied to machines with wings that revolve on a vertical axis or shaft. In effect, these machines may be said to screw their way up into the air, which is, of course, a very different movement from that of the aeroplane, which derives its motion from a screw on a horizontal shaft, giving a forward speed sufficient for the wings to lift the machine from the ground.

Perhaps the best-known helicopter of recent date is that of a Mr. Louis Brennan, the inventor of the famous high-speed mono-railway that bears his name. For some years the Brennan helicopter has been under test by the British Air Ministry, and during this time it has been very closely guarded. Strangers have not been allowed within a considerable distance of the hangar in which it is housed and the engineers working on it are all picked men, who are sworn to secrecy. Early one morning a few weeks ago, the Brennan helicopter was brought out of its shed and hastily started up with a view to a trial. Extraordinary precautions were taken to ensure that there were no unauthorised spectators, and it is said that the surrounding country was scoured for hours before dawn with this object in view. It must have been very disappointing to the officials concerned when the "mystery machine" crashed, after being out of its shed only a few moments. It was hastily rushed back to the hangar, the doors locked, and nothing has been heard of it since!

Two or three years ago an original form of flying machine, named by the inventor the "Auto-giro" because the wings revolve automatically, was produced by a young Spanish engineer, Don Juan de la Cierva. Recently, considerable interest has been shown in this machine and experiments with it have been carried out at the Royal Aircraft establishment, Farnborough, by Mr. F. T. Courtney, the well-known test pilot.

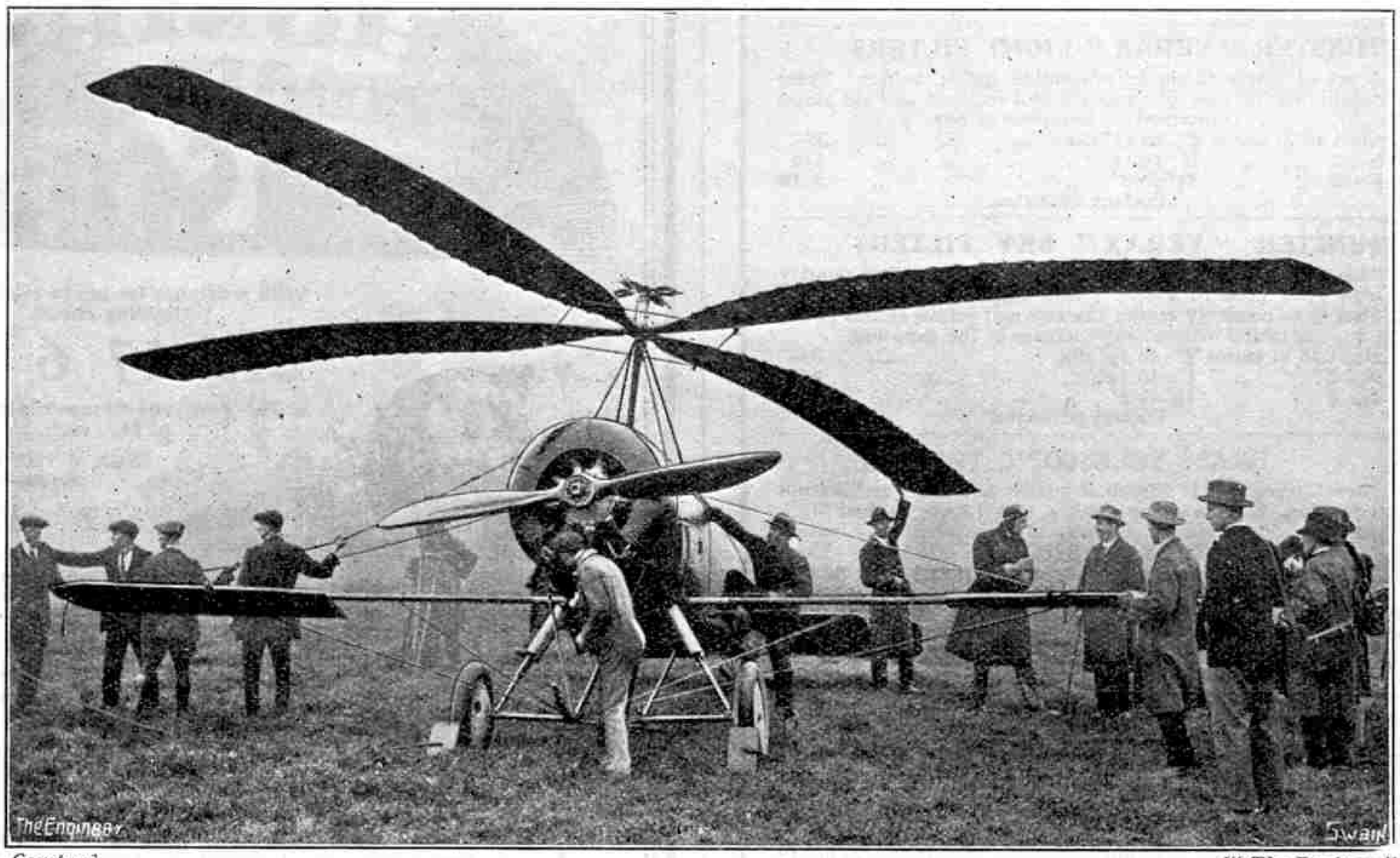
The Rotating Wings of the Auto-giro

The Auto-giro under test was originally an Avro biplane, but in its present form the wings have been removed and in their place a rod has been mounted at the front and immediately below the engine. As may be seen from the illustration on the next page, on each side of this rod is a small aileron, or wing, and by these the machine is controlled. A 120 h.p. Le Rhône engine, mounted in the ordinary manner, drives a two-bladed tractor propeller, the fuselage and undercarriage being of the standard Avro type.

A vertical shaft rises from the fuselage and is held in position by steel tubes in pyramid formation. To this shaft are attached four horizontal wings, the appearance of which bears a striking resemblance to the sails of a windmill. These "windmill sails" are hinged to the shaft, each "sail" being allowed a certain amount of vertical play on its hinges. In flight the position of the "windmill sails" is at right angles to the shaft, but the arrangement is such that they may be folded up, in a bunch, when so desired. It is important to

remember that the rotating shaft and its "windmill sails" are in no way connected to the engine.

The Auto-giro, on the perfection of which the inventor has already spent some £12,000, cannot technically be described as an aeroplane because it does not derive its lift from fixed wings. On the other hand, it is not strictly a helicopter, for the horizontally-revolving wings are not driven by the engine and therefore, since their rotation depends upon the forward movement of the machine as a whole it cannot rise vertically from the ground. Nor can it hover, stationary in the air, as should be possible with a true helicopter. The capabilities of the Auto-giro in this direction are similar only to those of a true aeroplane, which, as our readers know, can hover almost exactly over some particular spot when there is a head wind of sufficient force to give the necessary "lift," without the machine having to rely upon its own forward movement for "lift."



Courtesy ["*The Engineer*"

The Auto-giro ready to start

Note the men hauling on the rope to rotate the "Windmill Sails"

Vertical Descent Almost Possible

The performance of the Auto-giro is closely akin to that of the helicopter, however, in the fact that it is able to descend with the engine shut off. During the recent trials the Auto-giro alighted on the ground, having descended from a height of about 500 ft., at a point only a few degrees away from the base of a vertical line, drawn from the point at which it was hovering when the descent commenced. When it touched the ground in these circumstances its forward speed was not more than 10 miles an hour.

The Auto-giro also climbed several times to a height of about 300 ft. and descended in the normal manner, by gliding. In both kinds of descent the engine was cut off, but the "windmill sails," continuing to revolve, offered a certain amount of resistance to the air and the machine was thus able to land quite comfortably on the ground without damage to the landing gear. The distance covered after the machine first touched the ground varied from 3 to 30 ft.—a really remarkable performance.

The test pilot several times brought the machine down at an angle of not more than 30° to the vertical, even though there was a ground wind of about five miles per hour. On these occasions the Auto-giro descended at a rate of from 50 to 100 ft. per minute to within 5 ft. of the ground. By smartly opening-out his engine, the pilot then checked the downward speed and came to rest within 10 ft. of his first contact with the ground. On the occasion of another descent he glided down as in the manner of a normal landing, and after flattening out at a landing speed of 20 miles per hour, the machine stopped dead within 30 ft.

The most remarkable feature about the Auto-giro is undoubtedly the "windmill sails." Before commencing a flight it is necessary to start the sails rotating, because if this were not done it would take a long time for them to get up speed as a result of the aeroplane's forward motion along the ground. The sails are therefore given a rotary movement by means of a rope, coiled around four pegs, one on each sail, and hauled by assistants. This arrangement is only experimental, of course, and no doubt when the machine is re-designed a more convenient starting arrangement will be fitted.

When the sails are revolving, the engine throttle is opened and the machine runs forward, drawn by its horizontal propeller as in the case of an ordinary aeroplane. Suddenly, the windmill sails move upwards a little, which they are allowed to do by the fact that they are hinged at the point where they join the vertical shaft, and their speed of rotation increases. This is made possible by the automatic reduction of the incidence of the forward moving vanes, thus causing a difference in the drags on those blades that have their leading and trailing edges respectively foremost.

Controlled by Normal Methods

When a speed of about 140 r.p.m. is reached, and the machine has attained a ground speed of some 30 miles per hour, it is possible for it to rise from the ground, which it does by bounding upwards some 5 or 6 ft., and thereafter behaves in a similar manner to a machine of ordinary design. It climbs when the tail is held down, descends when the nose is brought down, and glides horizontally with the engine cut off, turning in the ordinary manner with a banking movement. Control is obtained entirely by means of the elevators at the ends of the cross-bar that takes the place of the normal

(*Continued on page 52*)

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¼-plate Ernemann. f/6.8 Detective Aplanat, Sector shutter, 1 to 1-100th sec. T. and B., leather bellows, rising and cross front, rack focussing adjustment, brilliant finder, level, plate back. List price £5 13s. Our price **£3 10s. 0d.**

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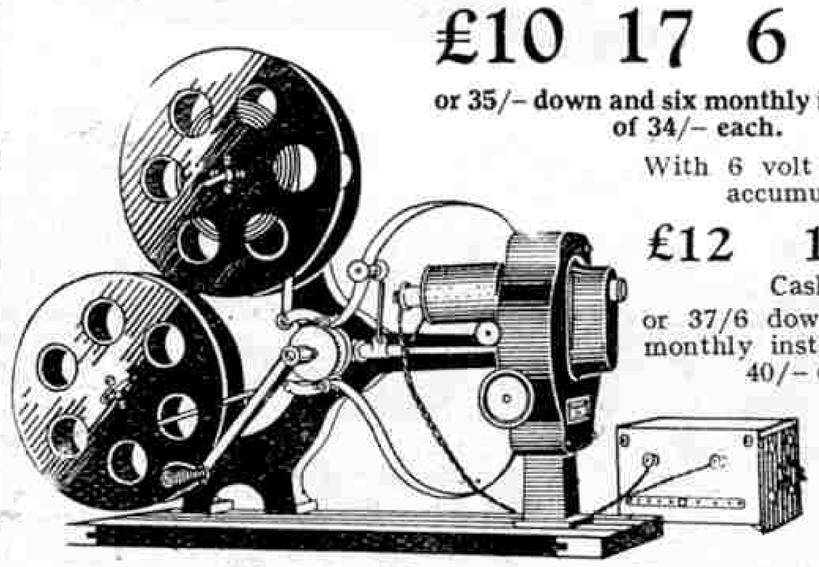
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X. TRICK PHOTOGRAPHY

"THE camera cannot lie" is an expression known to us all and on occasion most of us have repeated it. Although this is correct in a general sense, yet with all its honesty the camera may be made to produce results that are far from true. The purpose of this article is to show how "untruthful" photographs may be taken in such a manner as to provide the keenest interest and amusement both to the photographer and to his friends.

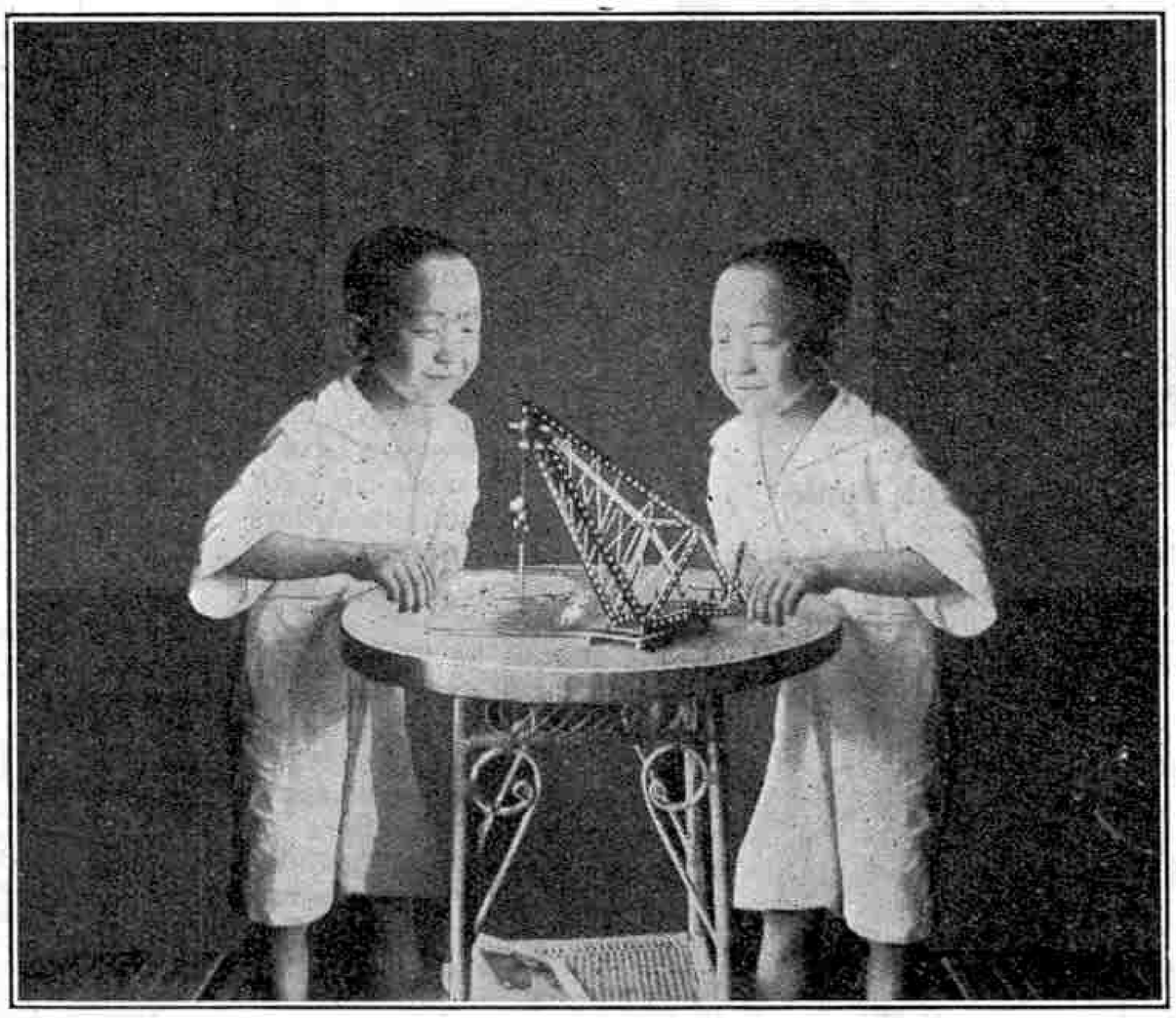
Photographing a Ghost

First of all let us attempt the production of a ghost. This sounds rather an ambitious scheme, but as a matter of fact it is quite simple. Almost any camera may be used, provided it is fixed on a tripod or placed securely on a firm table. In the latter case it will be necessary to hold the camera during the operations as success is impossible if it is allowed to move. The co-operation of two friends is required and the work may be carried out in any ordinary room if it is not too brilliantly lighted. If the light is too strong it may be modified without great difficulty.

The friend who is to play the part of the ghost may be dressed in any way that imagination suggests, his companion being in normal attire. The sitters should be placed sufficiently close together to come well within the plate or film, the ghost being on the darker side of the room. When these preparations are complete, the correct exposure should be ascertained as carefully as possible from an exposure meter or exposure table, and then a first exposure of about one-third the correct time should be given. When this is done the ghost, having played his part, is allowed to "walk" away.

It is important at this stage to see that neither the remaining figure nor the camera move in the slightest degree. The next step is to give a second exposure of such duration as to complete, along with the first exposure, the full time ascertained from the meter or table.

On development the ghost will appear as a shadowy form on account of the considerable under-exposure, whereas his companion and the remainder of the room will be well defined and quite normal. This process lends itself to an almost infinite variety of effects by means of a little skilful acting.



A Japanese Meccano boy assists himself to Build a Model!

"Double" Exposures

A trick on similar lines is that by which two photographs of one person appear on one print. These are known as "doubles," and to the uninitiated the effect is very mystifying. The easier forms of doubles, such as a person telling himself a joke or threatening to hit himself, may be produced even by the simplest cameras provided a little care is taken, but arrangements in which the figures are shown actually touching one another, shaking hands for instance, require a camera with a focussing screen.

First of all let us suppose we wish to obtain a double with a camera not fitted with a focussing screen. Whether the photograph is taken indoors or out, the background should be as subdued in colour as possible and the sitter's clothing should be appreciably lighter or darker than the background in order to produce a strong contrast. If the photograph is taken out of doors the background should be in the shadow and the sitter in the light. The camera is now placed in position and by means of the view-finder the area covered is carefully noted. Some small and inconspicuous marks should be made on the floor or ground to indicate the limits of the

view that appears on the plate or film. By this means it is easy to indicate the centre of the scene and thus prevent any overlapping by the figures in the separate exposures. The sitter is then posed in such a position that he occupies rather less than half of the view and a full exposure is given. He is then moved to the other half of the scene and suitably posed and a second exposure equal to the first is given. If chairs or other objects were used during the first exposure they must be removed before the second exposure is made.

When a camera fitted with a focussing screen is used the process is the same but it is rendered much easier and more elaborate effects may be obtained.

Seeing from All Angles

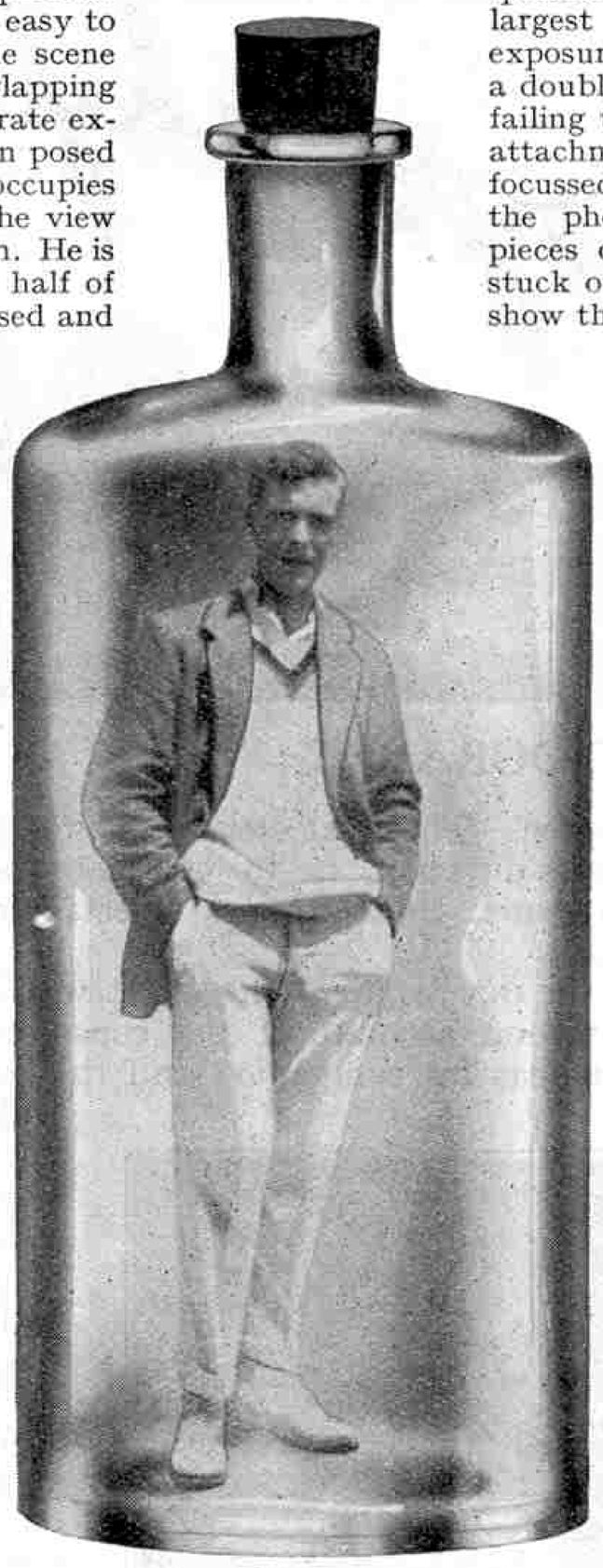
An interesting variation of doubles is one that is often employed by fashionable milliners who wish to show five different views of a hat without the trouble of making five different photographs or sketches. Strictly speaking, this is not trick photography and the method is as follows.

The sitter is placed on a chair with her back to the camera and facing two large mirrors placed at right angles to one another in a corner of the room. The camera is placed in such a position that the focussing screen or view-finder shows that the sitter is correctly centred and that two reflections are shown in each mirror. After the print is made, the edges of the mirrors must be trimmed away otherwise the secret is revealed.

A Man in a Bottle

The old trick by which a man may be made to appear to be imprisoned in a bottle is well worth trying by all photographers who possess cameras fitted with a focussing screen. It is very simple and can always be counted on to mystify the uninitiated. With a little care a satisfactory result may be obtained at the first attempt. In addition to the camera we require a large bottle, preferably of the square type, a dark-coloured background of an unpatterned type (a sheet of dark brown paper can be employed here). The sitter should be attired in light coloured clothing, to give as strong a contrast as possible against the dark background.

The bottle is photographed first at close quarters in order to obtain the largest possible image. For this exposure a camera equipped with a double extension is invaluable, failing this the ordinary portrait attachment will suffice. Having focussed the bottle, and before the photograph is taken, tiny pieces of stamp paper must be stuck on the focussing screen to show the exact position occupied by the image of the bottle. When this first exposure has been made the camera is moved well back from its original position, the bottle is removed and the sitter posed in its place. Here will be seen the object of marking the focussing screen, for the sitter must be focussed to come well within the pieces of stamp paper. A second exposure is now given, of course on the same plate as before. Provided that the placing is correct the sitter will appear to be unmistakably inside a huge bottle.



The Man in the Bottle

"Swollen Heads"

"The big head on a little body" is another type of freak photograph that always commands a laugh. We could fill pages with suggestions for pictures of this type, but the working method is practically the same in every instance. Two photographs of the same person are taken, one a "close-up" of the head and shoulders and the other a full length portrait taken at a distance so as to be on quite a small scale.

The photographs should be taken upon the same occasion so that the lighting conditions are the same for each, and the times of exposure and development should be identical. The object, of course, is to produce two prints as nearly as possible alike in tone and in their lights and shades.

When the prints are ready, the large head of the "close up" is carefully adjusted upon the small body of the other and gummed into the correct position, the unwanted portions of the prints being cut away as neatly as possible. The effect is greatly enhanced by a little pencil shading to hide the join between the two pieces. Very curious effects may be produced in this manner and the possible variations are almost unlimited to those with imagination.



The Milliner's Demonstration

(*Continued on page* 33)

"Loco" and "0 Outfit" Competitions

We regret that we are unable to publish the results of the above competitions in this issue, as promised in last month's "*Meccano Magazine.*" The overwhelming number of entries, and the remarkable standard of excellence displayed in nearly all the models submitted, have combined in making the distribution of prizes a difficult and lengthy task, and it was considered impossible to give each entry the attention it merits in the available time.

We are arranging to publish the results in detail, however, in the February Magazine. A number of the prize-winning models will be illustrated, and a special article by "Spanner" will contain some interesting and—we hope—helpful criticisms on the models submitted.

In view of the ready response from our readers, which has established beyond doubt the popularity of this new series of Meccano model-building contests, we have decided to announce two new competitions in each issue of the "*M.M.*" for the next two or three months at least. We feel confident that they will meet with the same splendid support as that already accorded to the first two of the series.

"Aeroplane" Competition

In this competition, as first announced in the December "*M.M.*," we are offering splendid awards for new Meccano models of Aeroplanes. The competition closes at the end of this month for inland readers, and entries from overseas competitors must be received by 30th April. Meccano boys should send along their efforts as soon as they are completed.

You may construct your model on the lines of any existing machine that comes under the general classification of "aeroplane"—monoplanes, biplanes, triplanes, gliders, helicopters, etc.—and you may use any Outfit or number of parts.

Entries will be divided into the following sections: SECTION A, for competitors residing in the British Isles; SECTION B, for competitors residing outside the British Isles. Competitors' ages will be taken into consideration when judging the entries. Prizes will be awarded for the best entries FROM EACH SECTION as follows:—FIRST PRIZE, £5-5s.; SECOND PRIZE, £3-3s.; THIRD PRIZE, £1-1s.; SIX additional prizes of 10/6 each.

When you have built your model, you should send in a photograph or a good drawing, together with any explanations you may think necessary, although the latter should be made as brief as possible. Write your name and address on the back of each sheet used, and state your age, and section in which your model is entered. Mark envelopes "Aeroplane Competition."

"No. 1 Outfit" Competition

As announced last month, we are offering prizes for the best models made entirely from a No. 1 Meccano Outfit. Models comprising parts that do not appear in this outfit will be disqualified. It is not necessary to use all the parts contained in the outfit. Those boys who possess larger sets may compete, providing they use only those parts that are in a No. 1 Outfit.

Entries will be divided into the following sections:—SECTION A, for boys under 12. SECTION B, for boys over 12 and under 16. SECTION C, for boys residing overseas, and not exceeding 16 years of age. Prizes will be awarded for the three best entries FROM EACH SECTION as follows:—FIRST PRIZE: Meccano Goods to the value of £2-2s. SECOND PRIZE: Meccano Goods to the value of £1-1s. THIRD PRIZE: Meccano Goods to the value of 10/6.

Closing dates for Sections A and B: 30th January. Overseas Section, 30th April.

New Zealand (1926) Model-Building Competitions

We wish to draw the attention of all readers who reside in New Zealand to the splendid Model-building Competition opened in that country by Messrs. Browning, Ifwersen Ltd., the Meccano Agents. Entries in this competition will be divided into three sections, according to competitor's ages, and over three hundred prizes are offered. The last day on which entries may be received is 31st May. Would-be competitors may obtain their entry forms, together with all necessary particulars, from their Meccano dealers, or direct from Messrs. Browning, Ifwersen Ltd., P.O. Box 129, Auckland.

THIRD SERIES:

Meccano Model-Building Contests

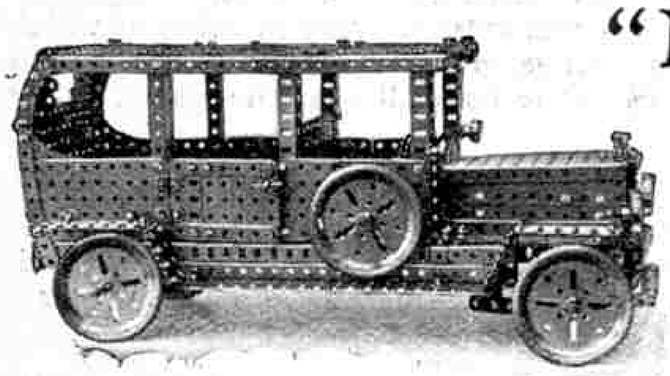
ANOTHER TWENTY-SEVEN PRIZES TO BE WON

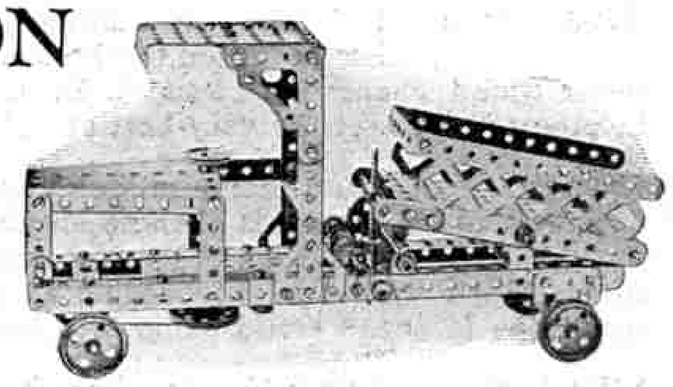
The competitions announced below are the third pair of a series which we are running throughout the winter months. Every contest is complete in itself and separate prizes are offered for the best entries received in each. Subsequent competitions appearing in the Magazine will be arranged on similar lines, but the size of the Outfit involved in the "Outfit" contests, and the type of model required in the "Model" contests, will continually change. In this way we hope to extend the opportunity of competing to all our readers, whether they possess a No. 0 or a No. 7 Outfit. The results of the competitions will be announced in the *"Meccano Magazine"* two or three months from the date of the issue in which they appear.

In the December issue of the *"M.M."* we announced the second pair of competitions of the series. These do not close until the end of the present month, and form the subject of an announcement on the opposite page.

"MOTOR" COMPETITION

£25 in Prizes





Entries in this competition will be divided into the following sections :

SECTION A, for competitors residing in the British Isles ;

SECTION B, for competitors residing outside the British Isles.

Competitors' ages will be taken into consideration when judging the entries.

Prizes will be awarded for the best entries FROM EACH SECTION as follows :—FIRST PRIZE, £5-5s. ; SECOND PRIZE, £3-3s. ; THIRD PRIZE, £1-1s. ; SIX additional prizes of 10 /6 each.

HOW TO ENTER. This month's competition should offer a wide scope for the inventiveness of our readers, for the subject on which models are required to be designed is a " motor-driven road vehicle." This definition is intended to embrace types of vehicles ranging from little two-seater cars to big commercial motor lorries ; it includes racing cars, limousines, landaulets, coupés ; 'buses, lorries, motor-vans, etc. Motor tractors, motor fire-engines, and similar apparatus, will also be accepted under this classification. You may use any outfit or number of parts.

The first prize in each section will be awarded to the competitor who builds the vehicle that the judges decide to be the best model entered in that section, and the second and third prizes will be awarded to the second and third best models, and so on. It is wise to remember that very often the simplest and most straight-forward models are better than th more complicated structures.

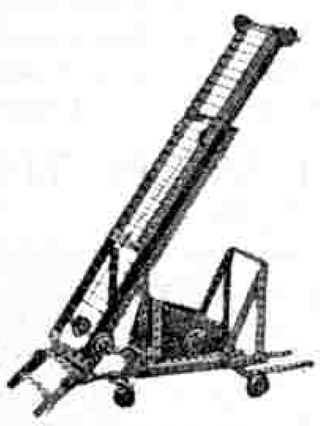
When you have built you model, you should send in a photograph or a good drawing, together with any explanations you may think necessary, although the latter should be made as brief as possible. Write you name and addres on the back of each sheet used, and state your age, and section in which your model is entered.

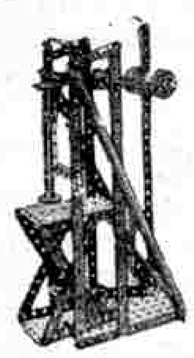
Closing date for Section A, 27th February, 1926. Overseas Section 31st May, 1926.

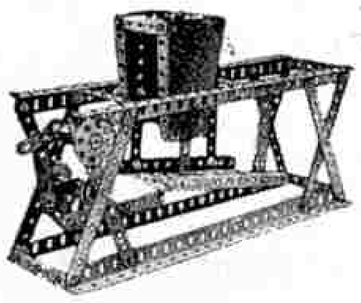
Mark envelopes " Motor Competition."

Do not send models. A clear photograph or good drawing is all that is necessary.

"No. 2 OUTFIT" COMPETITION







In this competition prizes are offered for the best models made entirely from a No. 2 Meccano Outfit. Models comprising parts that do not appear in this outfit will be disqualified. It is not necessary to use all the parts contained in the outfit.

The fact that some boys possess larger sets need not prevent them from competing, for their entries are eligible providing only those parts which may be found in the No. 2 Outfit are used.

An interesting feature of the contest is the fact that all competitors will be using similar number an variety of parts.

Entries will be divided into the followin sections :—

SECTION A, for boys under 12.

SECTION B, for boys over 12 and under 16.

SECTION C, for boys residing overseas, and not exceeding 16 years of age.

Prizes will be awarded for the three best entries from each section as follows :

FIRST PRIZE : Meccano Goods to the value of £2-2s.

SECOND PRIZE : Meccano Goods to the value of £1-1s.

THIRD PRIZE : Meccano Goods to the value of 10 /6.

Closing dates for Sections A and B : 27th February, 1926. Overseas Section, 31st May, 1926.

Mark envelopes " No. 2 Outfit Competition."

Models should not be sent. A clear photograph or good drawing is all that is necessary.

We append a list of parts contained in the latest No. 2 Outfit, for the reference of competitors.

Contents of Meccano No. 2 Outfit

10 of No. 1	12 of No.12	4 of No.20	55 of No.37	1 of No. 56
14 „ „ 2	2 „ „ 12A	4 „ „ 22	12 „ „ 38	1 „ „ 57
2 „ „ 3	2 „ „ 15	2 „ „ 22A	2 „ „ 40	2 „ „ 62
12 „ „ 5	1 „ „ 15A	1 „ „ 23	1 „ „ 44	2 „ „ 100
2 „ „ 6A	4 „ „ 16	1 „ „ 24	1 „ „ 45	1 „ „ 115
4 „ „ 8	2 „ „ 17	1 „ „ 34	8 „ „ 48A	4 „ „ 125
8 „ „ 10	2 „ „ 18A	12 „ „ 35	1 „ „ 52	2 „ „ 126A
4 „ „ 11	1 „ „ 19	1 „ „ 36	2 „ „ 54	



The Meccano Guild

A GREAT FELLOWSHIP OF BOYS

What the Guild Means The Meccano Guild is an organisation for boys, started at the request of boys, and conducted as far as possible by boys. In joining the Guild a Meccano boy becomes a member of a great brotherhood of world-wide extent, every member of which has promised to observe its three great objects ; wherever he happens to be—even in strange countries—he will know he has met a friend whenever he sees the little triangular badge. The Meccano Guild is bringing together Meccano boys all over the world, and is helping them to get the very best out of life.

How it Commenced More than a million boys in Great Britain derive their greatest indoor pleasure from Meccano. Before the Guild was formed, hundreds of these Meccano boys wrote to us every week. They told us how they wished they could be put into communication with other Meccano boys and how they longed to be able to meet them. They asked if arrangements could be made so that their wishes might become an accomplished fact. We responded to their repeated and increasingly numerous appeals, and as a result the Meccano Guild came into being.

Why You Should Join Every Meccano boy should be a member of the Meccano Guild. All who have studied its objects must agree that the Guild cannot fail to have a profound effect for good on the lives of its members. It is ready to be of service to each individual member—to help or give advice whenever requested. At the head—guiding and controlling, and taking a personal interest in this great movement—is the President, Mr. Frank Hornby, Inventor of Meccano and Managing Director of Meccano Limited.

HOW TO BECOME A MEMBER

Membership of the Guild is open to every boy possessing a Meccano Outfit, or Hornby Train Set, who satisfactorily fills in the prescribed application form. The only conditions are that members promise to observe the objects of the Guild and to wear their badges on all possible occasions.

The price of the Guild membership badge is 7d. post free in the United Kingdom, but members abroad will be required to pay 5d. extra for registered postage. A remittance for the necessary amount should be sent along with the form of application. The Guild badge is beautifully enamelled in blue and white and is made for wearing in the lapel of the coat. In addition to the badge each member receives a membership certificate, measuring 7″ × 9½″.

Write to the Secretary of the Meccano Guild, Binns Road, Liverpool, asking for an application form and full particulars. Write to-day, and put M.J. after your name for reference.

BADGE OF THE MECCANO GUILD MEMBERSHIP.

THE THREE GREAT OBJECTS OF THE GUILD

(1) To make every boy's life brighter and happier.

(2) To foster clean-mindedness, truthfulness, ambition, and initiative in boys.

(3) To encourage boys in the pursuit of their studies and hobbies, and especially in the development of their knowledge of mechanical and engineering principles.

MECCANO CLUBS

Meccano Clubs are founded and established by enthusiastic Meccano boys under the guidance of the Guild Secretary at Headquarters. At the present time there are over 100 affiliated clubs in various towns and villages in this country and abroad, together with a much larger number not yet affiliated. Each club has its Leader, Secretary, Treasurer and other officials, all of whom, with the exception of the Leader, are boys. If the nearest club to you is too far away for you to join, or if you are unable to join for any other reason, consider the possibility of forming a new club in your own district. A special booklet explaining " How to run a Meccano Club " is now ready, and will be sent to any reader (post free) on receipt of 2d. in stamps.

AFFILIATION WITH THE GUILD

When a Meccano Club has been successfully launched and good progress is being made, affiliation with the Guild is granted. A beautiful club certificate suitable for framing and hanging in the club-room is presented, and the club becomes entitled to such privileges as the loan of interesting lectures and club membership cards. All members of the Guild are eligible for the Merit Medallion, which is awarded to members who display special ability in connection with club work, or in helping the Guild.



THE CORRESPONDENCE CLUB

Members of the Guild are able to join the Correspondence Club, by which they are placed in communication with other Guild members in some other part of the country or abroad. To those boys who are interested in foreign languages the Correspondence Club presents a splendid opportunity of obtaining a correspondent in the particular country in the language of which they are interested. Full particulars and enrolment form will be sent on application.

THE GUILD RECRUITING CAMPAIGN

Every Meccano boy should become a member of the Guild and do his utmost to help to make the objects of the Guild widely known. With this end in view, a special medallion is presented to each member of the Guild who obtains three new recruits. As a mark of further merit the medallion is engraved with the name of the recipient and with the words " Special Award " when six more members are recruited. Full particulars of the Recruiting Campaign, together with a supply of application forms, will be sent on request.



The Secretary's Notes

My first task this month is the very pleasant one of wishing members of the Meccano Guild throughout the world a very happy and prosperous New Year. As regards the Guild itself I have no doubt whatever that, great as has been its progress in 1925, this will be completely eclipsed in the year that we are now beginning. So far as the clubs are concerned the Guild is undoubtedly in a much stronger position than ever before. This strength has been brought about mainly by the increase in the number of clubs and in the membership of those already existing, and also to some extent by the elimination of certain hastily formed, badly run clubs which, so far from being a help to the Guild, were an actual hindrance. I have the strongest possible evidence that the existing Meccano clubs are in a state of thorough efficiency, that they are in the hands of capable leaders assisted by capable secretaries, and that their steady progress along right lines is assured.

A Happy New Year!

Looking back over the past year, the feature that strikes me most is the enormously increased publicity that has been obtained for Meccano clubs and the Guild in general. In many of the smaller towns the local Meccano club has taken its place as a recognised institution, with the result that it receives its fair share of notice in the local press and commands the support of all those who are interested in the welfare of boys. Even in the larger towns and cities, where there are so many counter-attractions, Meccano clubs have held their own and firmly consolidated their position as rallying centres for the best type of boyhood. It cannot be disputed by anyone that our clubs do attract boys of the best type. There is no room in a Meccano club for an idle, disobedient or selfish boy and when such a boy happens to join a club he quickly realises that his way of life must be altered if he is to remain a member. I am glad to notice the rapid disappearance of the idea that a Meccano club is a sort of children's playroom presided over by a benevolent old gentleman, who sees that things do not get out of hand! Absurd notions of this kind cannot be held by anyone who has ever visited a Meccano club and seen its members at work.

Looking Back

Harwich Club's Exhibit



Our photograph shows the interesting exhibit of the Harwich Meccano Club at the local Horticultural Society's Show. The exhibit proved a great attraction and provided valuable publicity for the splendid work the club is carrying on under the capable Leadership of Mr. A. S. Hogg, who is ably assisted by A. E. Ward, the Secretary, and P. Whittingham and C. Jeffries, acting as sub-Leaders.

In the November "*M.M.*" I referred to the necessity for careful planning of Exhibitions in order to produce an effect that will immediately catch the eye of every visitor. The number of club Exhibitions held last year was far greater than in the previous year and the individual successes also were more complete is every respect. Most clubs that held exhibitions applied to me for the loan of a large model to enhance their display, and as I expect to receive even more of such applications during the coming year, I want to draw attention to the absolute necessity of giving me sufficient notice. Large models of this kind are not kept in stock at Headquarters but are built up in the Model Department as required. The staff of this department is very fully occupied throughout the year in designing new models and in experimental work of all kinds, and the time that can be devoted to building exhibition models is very limited. In order to make sure of obtaining a particular model for a particular date club secretaries should give me *at least three weeks' notice*, and if possible longer. I hope secretaries will bear this point in mind as it has been a great disappointment to me, during the past two months, to have to inform certain clubs that, owing to insufficient notice, I was unable to let them have the desired models. One other point of importance is that, in applying for a working model, secretaries should state whether they wish this to be fitted with the 4-volt or 220-volt electric motor. Clubs must prepay the carriage when returning models to Headquarters.

Models for Exhibitions

There are still many Meccano clubs which, although they have a good membership and are working on sound lines, have not yet taken the necessary steps to become affiliated with the Guild. I urge such clubs to consider seriously this question because by remaining, as it were, on the outskirts of the organisation, they lose a great deal in many ways. The requirements for affiliation are very simple—an adult leader, a regular meeting place and the holding of regular meetings.

Clubs Not Yet Affiliated

Special Merit Medallions Awards for 1925

ACCRINGTON—R. Rush. BIRMINGHAM (King Edward VI. School, Aston)—H. R. Smith. BLACKBURN (Holy Trinity)—E. Fryer. BLACKPOOL—J. Fraser, S. Slingsby. CLAYGATE—H. Cherry, F. Harber, W. Harber. EXETER—H. Bayley, L. W. Badcock, G. T. Townsend, L. Lendon. GREAT BADDOW—F. Grenham, G. Kemp, C. E. Rawlinson. GRIMSBY—J. H. Boreham, H. T. Christian. HARWICH—J. Brooks, W. Byles, R. Bates, W. Hatcher. HERNE BAY—S. Holland, H. Levin. KNUTSFORD—E. W. Edwards, J. Woodcock. LONDON :—BARNSBURY (Holy Trinity)—F. Johnson, W. A. Kebell, S. McDonald, A. Smith. NEWINGTON (St. Mary)—G. Burton, T. Imms. MELTON MOWBRAY—A. Pepper, W. Teather. NEWCASTLE-ON-TYNE—H. Cummins. NOTTINGHAM (West View)—C. Burrows, W. Sansom. REDRUTH—C. Burrows, B. Happe. RICHMOND—J. Viney.

OVERSEAS CLUB MEMBERS.

AFRICA :—CAPE TOWN (Observatory), K. Scaife. DURBAN—A. Altmann, S. White, R. M. Stephens. MALVERN (Johannesburg)—J. Mason, H. Price.
INDIA :—CALCUTTA—A. N. R. Chowdhry, M. L. Mitter. DELHI—B. P. Mitra, R. Raman.
NEW ZEALAND :—AUCKLAND (WISEMAN'S)—W. Shearer.

MEMBERS NOT ATTACHED TO CLUBS.

AUSTRALIA :—VICTORIA—P. Goldin. FRANCE :—MOSELLE—E. Willette.



CLUB NOTES

Christ Church M.C.—A successful Exhibition was held last month for which a model was loaned from Headquarters. The new gas fire installed in the club room has been received with unanimous enthusiasm. A Meccano Concert Party is being organised and a club Magazine is also in preparation. Club roll: 36. *Secretary*: R. H. Bentley, 81, Abbey Lane, Stratford, E.5.

Queen Elizabeth M.C.—The working centre has been changed, the Science Laboratory now acting as club room. Meetings are held on two evenings each week and members have been enthusiastically preparing for an Exhibition of Models. *Joint Secretaries*: A. Sprague and J. Clarke, both of Queen Elizabeth's School, Crediton, Devon.

Rosyth M.C.—Has obtained a new club room. Lectures and Model-building Competitions have proved highly successful and an interesting discussion of the hobby of stamp-collecting was recently enjoyed. Club roll: 13. Average attendance: 10. *Secretary*: E. T. Hunter, 79, Admiralty Road, Rosyth.

St. James' Choristers (Exeter) M.C.—Held an Exhibition of Models in November at which a large model of a Tramcar built by five of the members, under the direction of the Leader, Mr. M. C. Hodder, attracted a great deal of interest. A Zeppelin model, an original design of the constructors, proved another attraction. A fine model of a Horizontal Engine, operated by a 220-volt electric motor, was loaned from Headquarters for the occasion. Ronald C. Davey recently won the first prize of £20 for an Essay in a Competition organised by the proprietors of Jeyes' Fluid, and thus furnished another example of the enterprise that is typical of the members of this club. *Leader*: Mr. M. C. Hodder, 60, Elmside, Exeter.

Reading M.C.—Mr. H. T. Morley, F.R.S.A., Author of "The Monumental Brasses of Berkshire," recently delivered a very interesting lecture on Hobbies and the occasion proved so popular that the attendance was the largest since the opening of the club. An interesting feature is the Literary Evening, on which magazines are passed round and read and then questions are asked on their contents. Members are looking forward to a demonstration on Pottery by Mr M. Harding. Club roll: 43. *Secretary*: F. G. M. Wheeler, 72, Pell Street, Reading.

St. Mary (Newington) M.C.—The two days' Exhibition proved exceedingly successful and was attended by over 250 visitors among whom were the Lady Sudley, the Bishop of Kingston and the Mayor of Southwark. There was a very fine show of models including the Motor Chassis; a Swing Boat geared so that the clockwork motor worked for 6½ minutes on one wind; a Butter-Maker; and the latest type L.G.O.C. Omnibus. A Hornby Railway proved a great attraction and to use the Leader's own words it "detained visitors longer than they intended!" The Marine Engine and the Horizontal Steam Engine loaned from Headquarters worked perfectly and opened the eyes of many of the visitors in regard to the instructive value of Meccano. In addition there was a good display of Fretwork and Wireless. The money raised by this Exhibition goes towards the Church Restoration Fund and the club is benefited by a material increase in membership. This was the most successful Exhibition ever held by this club and the splendid result was due mainly to the loyal co-operation of all members. Club roll: 139. *Secretary*: Mr. C. Curle, 37, Pullen's Buildings, Peacock Street, London, S.E.

Ruislip Common M.C.—Model-building continues to be a great feature and marks are awarded by the Leader according to merit. Fred Collins recently exhibited an attractive model of a Motor-Cycle and Side Car, fully equipped from exhaust pipe to lights. A recent lecture on "Electro-magnetism," delivered by the Leader (Mr. Grosvenor) was a great success. *Secretary*: E. J. Stent, 2, Reservoir Road, Ruislip Common, Middlesex.

Norwich Enterprise M.C.—Has had the misfortune to lose the services of its Leader, Mr. S. I. Mitcham, who finds it impossible to attend further meetings. The fine work that Mr. Mitcham has done for the club is very highly appreciated. *Secretary*: C. R. Agar, 73, Vincent Road, Norwich.

Marsh Street, Conway M.C.—Impromptu speeches form a regular feature of the meetings of this club and provide excellent training for members in expressing their own views and ideas. A lecture on "Photography," a Debate, and a Mock County Court have been held with outstanding success. Other interesting lectures are arranged for future meetings. Club roll: 16. *Secretary*: C. W. Redfern, 34, Church Hill Road, Walthamstow.

Maryfield (Dundee) M.C.—An Anniversary Meeting and Concert proved very popular and the proceeds realised £3. An interesting Lecture on a Transporter Bridge was delivered by the President. A vice-Leader and a committee of three have been appointed. Club roll: 23. *Secretary*: S. Smith, 14, Maryfield Terrace, Dundee.

Blagdon St. Andrew's M.C.—Members are enthusiastically preparing for a Model Exhibition, which is to be a special feature of the Blagdon Horticultural and Industrial Society's Spring Show. The Exhibition is divided into four sections, money prizes being awarded in each. A Concert is being arranged and a local lady has kindly offered her services as pianist. The Rev. Prickard recently delighted members with a short address on his Adventures in India, and another visit from him was promised and is eagerly anticipated. *Secretary*: Miss Kathleen Day, "Seymour Arms Hotel," Blagdon, nr. Bristol.

Bures M.C.—Has adopted the popular "Sectional" scheme of work, and now comprises "The Spanners" and "The Screwdrivers." Apparently the younger boys are "Spanners" and work under this banner until they have grown into "Screwdrivers." A Christmas social was greatly enjoyed by all. A Lecture was recently delivered by the Secretary and also a talk on "Ten Minutes Late," by D. MacDonald. *Secretary*: John Deaves, "Radio House," The Croft, Bures, Suffolk.

Meccano Club Presidents

No. 5. Mr. F. Wiseman



Mr. Frank Wiseman is the Founder and President of Wiseman's Meccano Club, New Zealand. This club was formed in 1924 and the first meeting was attended by no less than 150 boys. Affiliation with the Guild was granted in the same year and since that time the membership has grown at a remarkable rate. To-day, with a membership of 820, this is the largest Meccano Club in the world.

The President takes the chair at almost every meeting and the phenomenal growth of the club is very largely due to his personality and enthusiasm. He is ably assisted by Mr. Shearer, who combines the functions of Leader and Secretary with remarkable success.

Regular Model-building Contests form a prominent feature of this club's work. Useful prizes are awarded and competition is very keen.

Holy Trinity (Blackburn) M.C.—Lectures, Model-building and Drawing are chief attractions, and on one evening each boy picked a subject and delivered a miniature lecture, with great success. J. Kay distinguished himself at the local Swimming Gala, carrying off three medals and a Silver Cup. A Christmas Social was successful. *Secretary*: T. Donald, 6, Camden Street, Blackburn.

Accrington M.C.—A Stamp Evening proved highly successful, each member bringing his own collection and exhibiting its chief attractions. The club Magazine has been revived, and it is hoped that it will flourish. A small printing outfit has been obtained to enable copies to be printed. A Model Exhibition is being arranged. Club roll: 25. *Secretary*: V. Waterhouse, 45, Ramsbottom Street, Accrington.

Victoria (Glasgow) M.C.—Is doing excellent work under its new Leader, Mr. T. Baillie, who is ably assisted by the committee. Members re-elected the existing committee, showing the confidence reposed in these officials. A general meeting and a Lantern Lecture on "London's Underground," to which visitors were invited, was a very successful function. Club roll: 44. *Secretary*: Robert White, 22, George Street, Scotstoun, Glasgow.

Peebles M.C.—The membership has become rather depleted, but the Leader, Mr. Flint, with several faithful members, is endeavouring to get the club in good working order again. Meccano boys in the district who wish to support the club should communicate with the Leader: Mr. S. G. Flint, Y.M.C.A., Peebles, N.B.

Holy Trinity (Barnsbury) M.C.—Has held another successful Exhibition resulting in an addition of £7 to the club funds and also the prospect of a considerable increase in membership. The room was well arranged, the centre being occupied by a double-track Hornby railway layout with a special track for the new Hornby Electric Train. The models were not quite so numerous as last year but many of them were extremely interesting, including a Flip-Flap, a Terminus Station, two Station Platforms, a Motor Chassis, the latest "N.S." type of L.G.O.C. motor-bus, etc. Headquarters loaned models of a Transporter Bridge and an L.M.S. Tank Loco. Cinema and Lantern Exhibitions were a great success, as was also the Radio Refreshment Lounge. In the lower hall Radio Demonstrations were given by the Holy Trinity Radio Club who co-operated in the Exhibition. Representatives of several Meccano Clubs paid a visit, including the St. Mary (Newington), Christ Church, Stratford and Ruislip Common Clubs. Club roll: 24. *Secretary*: R. Clark, 77, Richmond Road, Barnsbury, London, N.1.

Great Baddow M.C.—A recent Whist Drive realised £5. The parents of members were very kind in helping to arrange the hall and in distributing refreshments. A No. 5 Meccano Outfit is being purchased, and also a 4-volt accumulator. An anniversary social on 9th December celebrating the club's first birthday, was entered into with the greatest enthusiasm. *Secretary*: T. Boreham, Post Office, Baddow Road, Chelmsford.

Westcliff and District M.C.—Has a splendid Magazine "The Hound," which it is hoped shortly to have on sale in local shops. Scoutmasters J. E. Blackwell and W. H. Dunn were recently appointed joint Asst.-Leaders, and the members of the committee were re-elected. *Secretary*: D. S. Cecil, 22, Valkyrie Road, Westcliff-on-Sea.

Harwich M.C.—The club roll has been substantially increased owing to the recent successful Recruiting Campaign. Special Merit Medallions have been awarded to Masters R. Bates and T. Brooks for their good work for the club. An Exhibition has been held with great success, including Meccano Models, Raffia, Fretwork, etc. The youngest member of this club is about 5 years of age and the oldest 19, but working on a sectional scheme there is congenial occupation for everyone. Club roll: 68. *Secretary*: Alfred E. W. Ward, Osborne House, Pepys Street, Harwich.

Clubs Not Yet Affiliated

Mossley (Manchester) M.C.—Good progress is being made although permanent headquarters have not yet been found. Weekly meetings are held and there is a special Model building Competition for No. 1 Meccano Outfits. A recruiting Campaign is to be organised. Club roll 15. Average attendance: 11. *Secretary*: Jack Yates, 8, Wood Bank Terrace, Mossley, nr. Manchester.

Hoylake M.C.—This recently-formed club has made a good start in a small way and shows signs of becoming well established. An energetic publicity campaign is being carried on and it is hoped that this will result in an increased membership. *Secretary*: J. L. T. Young, 86a, Market Street, Hoylake.

Seestu (Paisley) M.C.—Is urgently in need of a Leader, all efforts so far to find a gentleman to take this post having been unsuccessful. The members are full of enthusiasm and if a Leader can be secured good progress appears probable. *Secretary*: W. Robertson, 58, George Street, Paisley.

Bolton M.C.—The membership is increasing satisfactorily. A library has recently been started and this already includes a number of very good books. It is intended shortly to have a photograph taken of the members. Club roll 18. *Secretary*: Hubert Henshaw, 35, Kenda Road, Bolton, Lancs.

Bellahouston M.C.—Although a Leader has not yet been obtained, members are very keen and enthusiastic. Successful Hornby Train and Meccano nights have been organised, and a Halloween party at which members sang and recited was thoroughly enjoyed by all. Club roll: 13. *Joint Secretaries*: Master J. Malcolm, 16, Golf View Terrace, Cardonald, Glasgow, and Master N. Ralph, 9, Torbeck Street, Bellahouston.

Darlington M.C.—Recently held a fine Exhibition of Models, followed by a Concert. The secretary took the part of a girl to make the sketch a success, and all the members rose to the occasion in true Meccano spirit. Mr. Pankhurst was obliged to resign the Leadership recently on account of business ties. Members keenly appreciate the interest he has taken in their progress since the commencement of the club and the new Leader, Mr. Bird, will have all possible support from them. It is hoped to secure affiliation shortly. *Secretary*: L. Pankhurst, 10, Duke Street, Darlington.

Birkby and District M.C.—Is making good progress though suffering from the great drawback of being without an adult Leader. It is hoped to remedy this defect shortly and thus make affiliation possible. *Secretary*: T. W. Frost, 94, Birkby Hall Road, Birkby, Huddersfield.

Clackmannan M.C.—A club room has now been obtained and the Rev. R. A. Agnew has kindly accepted the Leadership. As soon as meetings are being held regularly, members hope to obtain affiliation with the Guild. The secretary, and incidentally the founder of the club, is H. Russell, Laurel Bank, Clackmannan, Scotland.

Competition Page

Are You Good at "Limericks?" A New Contest

During the past few weeks there has been quite an epidemic of poetry among our readers and many of the verses sent to us have shown distinct talent. Some of our budding poets have even extended their activities to the Puzzles Page and one set of solutions for a November contest was formed in rhyme, some of which made really excellent reading.

Rhyme seems to be so popular among our readers just now that we have decided to provide an opportunity for them to show their skill in this direction and so we announce this month a "Limericks" Competition.

Our readers need no introduction to this form of verse, some examples of which were given in the article on Edward Lear in our Special Christmas issue last month. Everyone is familiar with the characteristic rhythm of "Limericks," of which the following is a typical example :—

A man of the name of O'Brien,
When out for a walk met a lion.
With a terrible roar
It bit him in four
And now he's a harper in Zion.

The possibilities of "Limericks" are very varied, and we expect to receive a large number of really first-class entries, and of these we shall print a selection when the result is announced.

Competitors may submit as many entries as they wish, but each must be written upon a separate post-card along with the name and address of the competitor. Entries should be addressed to "Limericks," Meccano Magazine, Binns Road, Liverpool.

Prizes of Meccano goods to the value of £1 1s. 0d., 15/–, 10/6 and 5/– respectively will be awarded to the four best entries.

Closing date 30th January. Overseas, 31st May.

23rd Photographic Contest

Following our custom of setting subjects based upon our Photographic articles the subject of this month's competition will be a "Trick Photograph." In this contest competitors have an absolutely free hand and the subject is one that offers full scope to the imaginative camera owner. The subject is very fully dealt with in our article this month (see page 57). In judging the competition special credit will be given for original ideas.

The contest will be divided into the usual sections, 'A' for those of 16 and over and 'B' for those under 16, and prizes consisting of Photographic Materials or Meccano Goods to the value of 15/– and 7/6 will be awarded to the first and second entries in each section.

Closing date 30th January. Overseas, 31st May.

12th Drawing Competition

"The Guild Secretary As I Imagine Him To Be"

This subject has been chosen as a result of numerous requests made by members of the Guild. Many of our readers will remember that a very similar competition was held two years ago, the Editor then being the subject. There will be the usual two sections 'A' for those over 16 and 'B' for those under. Prizes of Drawing Materials or Meccano Goods to the value of 15/– and 7/6 respectively will be given to the first and second entries in each section.

Closing date 31st January. Overseas, 31st May.

Results

Loco Parts Contest

This competition proved to be one of the most popular we have ever held. A surprising amount of technical knowledge was displayed by competitors in the 'B' Section and in Section 'A' quite 50 entrants deserved a prize. After careful consideration the prizes were awarded as follows :—

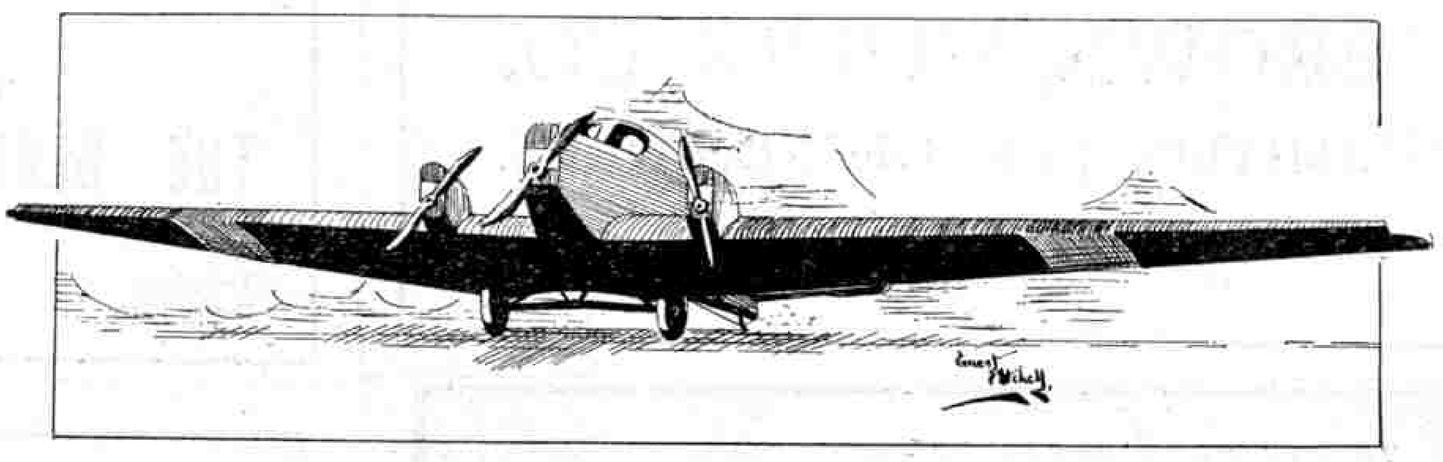
Section A—First Prize : J. Watson (Airdrie) ; Second Prize : A. D. Smalley (West Kensington, W.14). Section B—First Prize : W. G. Barnes (Ashford, Kent) ; Second Prize : J. Scott (Shaw Heath, Stockport).

Consolation Prizes (Magazine Spring Binder)—R. B. Haddon (Glasgow) ; T. Turner-Smith (Springburn, Glasgow) ; J. H. Lister (Ryhill, nr. Stamford, Rutland) ; A. J. Innes (Stirling) ; T. A. Blackett (Swilly, Plymouth) ; R. Jones (Acocks Green, Birmingham).

11th Drawing Contest

Every type of motor-propelled vessel was depicted in this competition, from the humble fishing smack to a lordly fruit-carrying 8,000 tonner. Racing craft were the most popular and some of the entries were thrillingly realistic. Drawing or painting materials (or Meccano Products) to the value of 10/6 and 5/– respectively have been awarded to the first and second in each section as follows :—

First Prizes—Section A : L. B. Braithwaite (Slyne, nr. Lancaster). Section B : J. A. S. Brock (Midway, Walton-on-Thames). Second Prizes—Section A : J. H. Prentice (Motherwell). Section B : A. Lumley (Chelford, Cheshire).



This drawing, of a Junkers All-Metal Aeroplane, was awarded First Prize (Section A) in our 10th Drawing Contest.

20th Photo Contest

The numbers of entries for our photographic contests show no sign of falling off in comparison with the summer level, in fact the number for this competition was slightly higher than usual.

Awards :—

First Prizes—Section A : F. G. Brook (Ipswich, Suffolk) ; Section B : J. Broadbent (Newlands, Glasgow). Second Prizes—Section A : W. H. Evernden (Faversham, Kent) ; Section B : N. E. Hulse (Wolstanton, Stoke-on-Trent).

10th Drawing Contest

Entries for this contest were very numerous and, generally, of very high standard. It was pleasing to see a large number of entries from boys under 10.

Awards :—

First Prizes—Section A : E. Mitchell (Chester) ; Section B : H. R. Humphreys (Kilburn, N.W.6). Second Prizes—Section A : W. J. Glenn (Ipswich) ; Section B : H. C. Collins (Rochdale).

Match Puzzle Contest

The special prize of £1-1s.-0d. has been awarded to G. Lesson (Derby) and a consolation prize of a Magazine Binder to E. Butcher (Crawley, Sussex).

Football v. Cricket Essay

That Meccano boys are keen sportsmen was evidenced by the huge number of entries for this competition. Football appears to be slightly more popular than cricket, but the summer enthusiasts certainly presented a good case.

Awards :—

First Prizes—Section A : A. Fecitt (Blackburn) ; Section B: W. L. Dawson (Gillingham, Kent) ; Second Prizes—Section A : I. G. Thomas (Rhondda, Glam.) ; Section B : Helen A. Storey (New Brighton).

November Puzzles Competition

Meccano Goods to the value of £1-1s.-0d., 10/6 and 5/– respectively have been awarded to—H. A. Trump (Bristol) ; Lionel Miller (Ramsey, Isle of Man) ; Kenneth Smith (Ross-on-Wye).

Overseas Results

7th Drawing Contest

The following are the awards :—

First Prizes—Section A : Betty Roinska (Szkola, Tczew, Poland) ; Section B : H. Turner (Hastings, N.Z.) Second Prizes—Section A : B. Gravener (Sydney, N.S.W.) ; Section B : K. Robertson (Wellington, N.Z.)

17th Photo Contest

"A Happy Holiday Scene" was the subject of this contest and the judging proved to be a pleasant experience, as most of the competitors certainly captured the spirit of happiness.

Awards :—

First Prizes—Section A : F. Van Bulck (Paris XI) ; Section B : J. Lindesay (Whangarei, New Zealand). Second Prizes—Section A : K. E. Nichi (Tokio) ; Section B : B. Goumeniouk (Dairen, Japan).

Cricket Voting Competition

The result of the voting was as follows :—Hobbs, Tate, Hendren, Kilner, Sutcliffe, Woolley, Strudwick, Macaulay, Carr, Holmes and Gilligan, with Hearne next on the list. A. W. Carr and A. E. R. Gilligan were joint favourites for the captaincy. No competitor gave an eleven exactly in accordance with the voting.

Awards :—

1. S. A. Shepherd (Hamilton, N.Z.) ; 2. R. J. Montgomery (Melbourne, Aust.) ; 3. S. C. Choudhury (Dacca, Bengal) ; 4. J. Morris (Chateau D'Oex, Switzerland).

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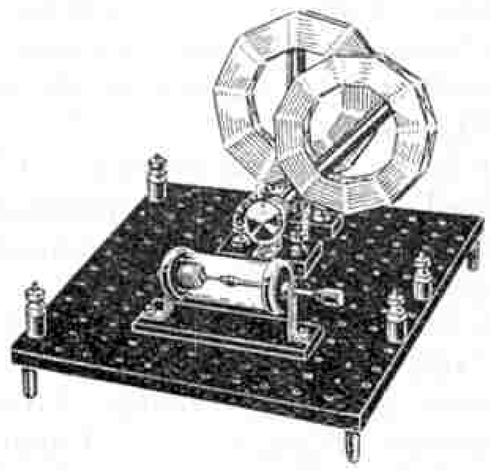
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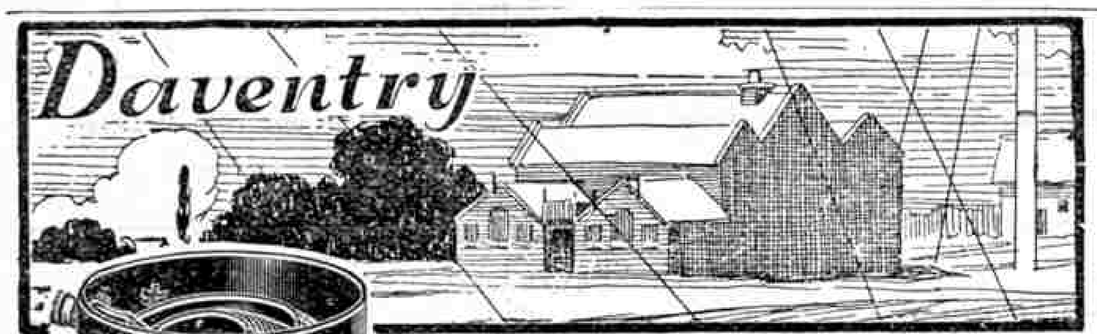
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January Puzzle Competition

THE December Puzzle Competition has brought in such a deluge of entries that I have come to the conclusion that the puzzles were too easy! This month, therefore, I have tried to find a selection that will really test the keen wits of my readers, and in order to win a prize competitors must endeavour to solve every puzzle.

Prizes of £1-1s., 15/–, 10/6 and 5/– will be awarded respectively for the four best sets of solutions of the whole of the puzzles on this page. In addition, five consolation prizes of "Meccano Magazine" spring-back binders will be awarded to the five competitors whose entries are considered to be the next best.

Each competitor may submit more than one set of solutions if he wishes, and in cases where more than one solution is possible any correct one will be accepted.

Entries must reach this office on or before 31st January and there is no Overseas section.

Puzzle No. 162.

In the following sentences the words containing asterisks must be completed by inserting one letter in place of each asterisk :—

"Well I'm off," said Jack as he bade them farewell. Don't drink too much *off**, remember," said his uncle, who was an off**** in the army. As he *off** his hat to his sister, she **off**** him a tin of *off***. He promptly off**** her one. "Well, son, I must be off to my off***," said his father. Don't get drowned!" the smallest off****** of the family shouted. Jack **off** at the idea. "The sea will never hurry me to my *off**," he replied. Their parting admonitions were not to off*** any of the off****** of the company with his too-ready temper. With this ****-off, he left, as his ship a *off (which is the Dutch name for a two masted vessel) had already appeared in the off***.

* * * *

Puzzle No. 163.

Starting from a certain cell in the following figure, and passing from one cell to another adjacent to it, trace out a familiar proverb. Each cell must be visited once only.



Puzzle No. 164.

Using 20 matches, form three squares and four triangles in such a manner that, by moving two of the matches, six squares but no triangles will be produced.

Puzzle No. 165.

The first of first is first,
The second and third are nothing,
The last of last is last.
What is it?

* * * *

Puzzle No. 166.

A man informed a friend that he had just sold two houses for £990 each, and that on one house he had lost 10 per cent. and on the other gained 10 per cent. His friend replied: "Then you are exactly where you were before you bought the houses." Was this correct?

* * * *

Puzzle No. 167.

With 3 matches make a triangle. Now take three more matches and make seven additional triangles and one hexagon without altering the size or shape of the original triangle.

* * * *

Puzzle No. 168.

Place eight coins in a row and get them into four pairs (one coin on another) by moving one coin at a time and passing over two coins at each move. Having done this, repeat the process with rows of ten, twelve, fourteen and sixteen coins, respectively.

* * * *

Puzzle No. 169.

Well known to all as a covering for the head,
Change my initial and a doze I mean instead.
Change it once more and an opening you will see,
Exchange again, I'm found inside a tree.
Change yet again, in this my mother nursed me.

* * *

Puzzle No. 170.

An orange grower sent away two loads of oranges on the same day. One load consisted of 9,044 oranges and the other load of 6,916. If all the packing cases held the same number, what would be the smallest number of cases he required and how many oranges were in each case?

* * * *

Puzzle No. 171.

Re-arrange each of the following groups of letters to form the name of a well-known British locomotive :—

HTOSNOGSAIRT
LDNAGHIHFICHE
ILFGNYMTSOCASN
ACLNLBLPECMA
TNSIAMWOEOHTLBRA
PNINSNEDETLCAES
GNKAIHTRRU
CUSRROERP
CHOOG
ENHGKTIFGOLNOCELEDEFEHT

* * * *

Puzzle No. 172.

An engine driver one night noticed that the figures in the number of his engine when added together equalled the number of coal trucks that his engine had been pulling, and when multiplied together equalled the total number of wheels on his trucks, each of which had four. What was the number of his engine?

* * * *

Puzzle No. 173.

The keeper of a menagerie was asked by a boy how many birds and beasts he had altogether.

"I do not remember exactly," was the reply, "but I know there are 36 heads and 100 feet." How many creatures of each kind were there?

* * * *

Puzzle No. 174.

Aunt Eliza had been on a visit to seven places and her trunk had been duly labelled for each place. Later the labels all became torn at one or both ends and the letters on the remaining fragments of the labels, if placed one after the other, read as follows :— "Mad Aunt Came Hopping Right Over Hatstand." What places did Aunt Eliza visit?

* * * *

Puzzle No. 175.

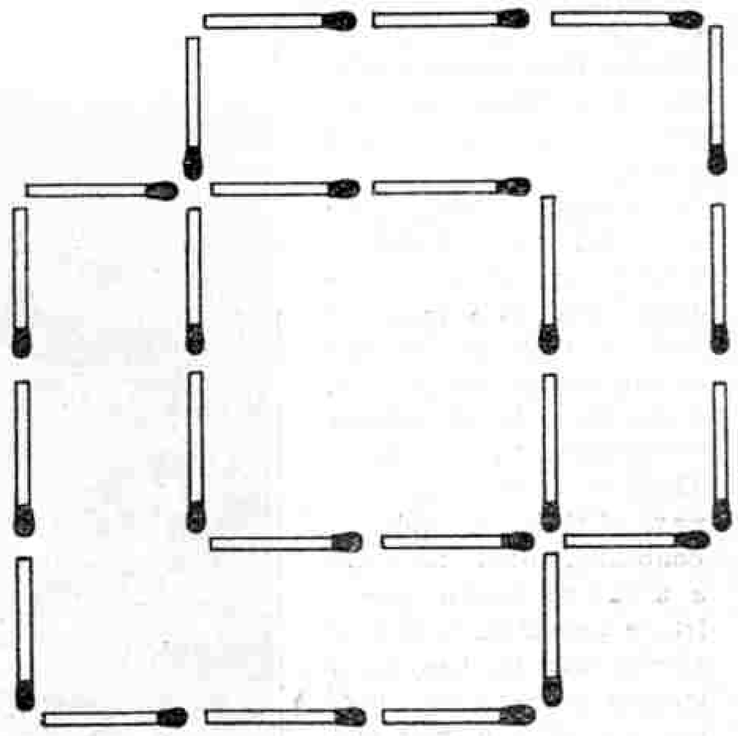
Two inmates of a mental hospital were asked their ages, and were then requested to add their ages together. After a little thought one said 13 and the other 378. One had subtracted the two ages and the other multiplied them. What were their respective ages?

Answers to Last Month's Puzzles

No. 150. The official would have to travel 103 miles.

* * * *

No. 151. After removing 16 matches the position was as shown below :—



No. 152. The carrier's scale of charges is 5 lb. for 3d., with an additional 1d. for every pound over that weight.

* * * *

No. 153. Coal.

* * * *

No. 154. The man bought 20 bicycles.

* * * *

No. 155.

8	256	2
4	16	64
128	1	32

* * * *

No. 156. (1) Ford; (2) Humber; (3) Rover; (4) Hillman; (5) Dodge Bros.; (6) Singer; (7) Trojan; (8) Bean; (9) Moon; (10) Vulcan; (11) Overland; (12) Swift; (13) Standard; (14) Napier.

* * * *

No. 157. Note—not.

* * * *

No. 158. Red Root Put Up To Order.

* * * *

No. 159. CO-NUN-DRUM.

* * * *

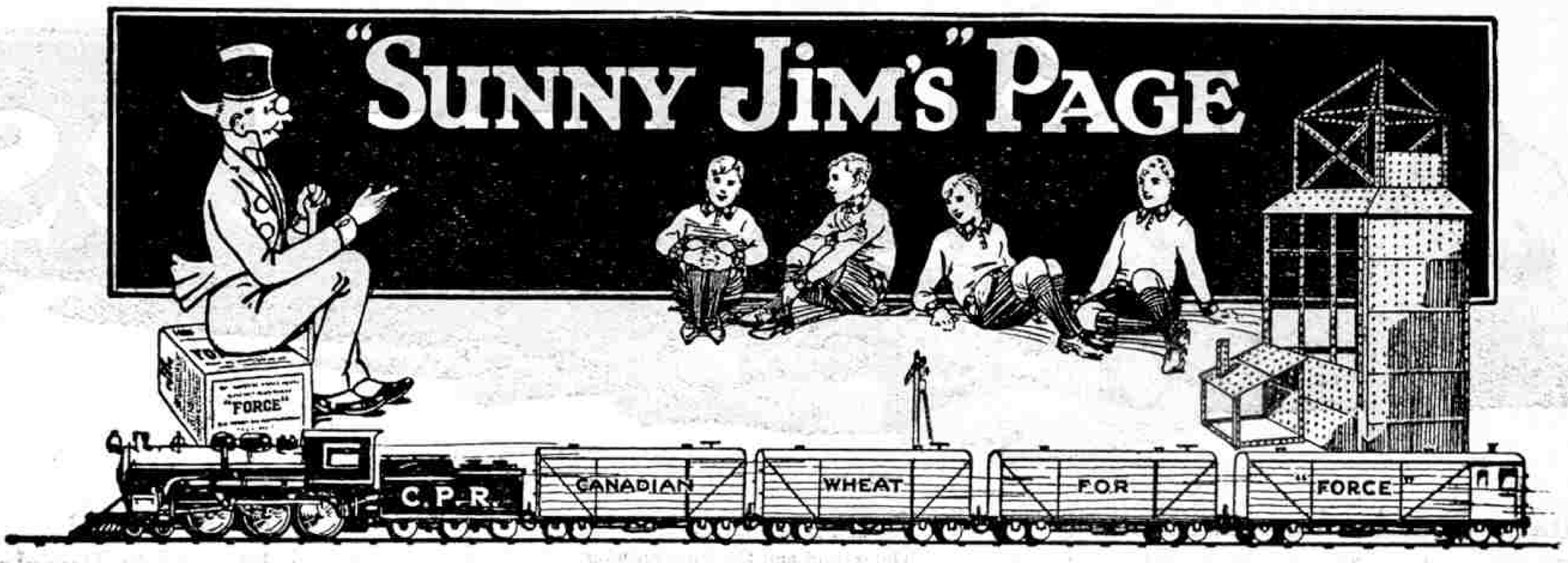
No. 160. Dear Ida, The weather here is rainy and sometimes snowy. We are, however, in good hope of its becoming more clear. Our food here consists largely of ham, which is rather salt, and cakes of grain. We seldom get fish, egg or sheep's head, which have to be brought from town by van. All the same we have everything to our heart's desire. Farewell, Sydney Fraser.

* * * *

No. 161. Sir, you will understand that in the year 1877 France was divided, laws were set aside, religion was upside down, and rebellion in every corner.

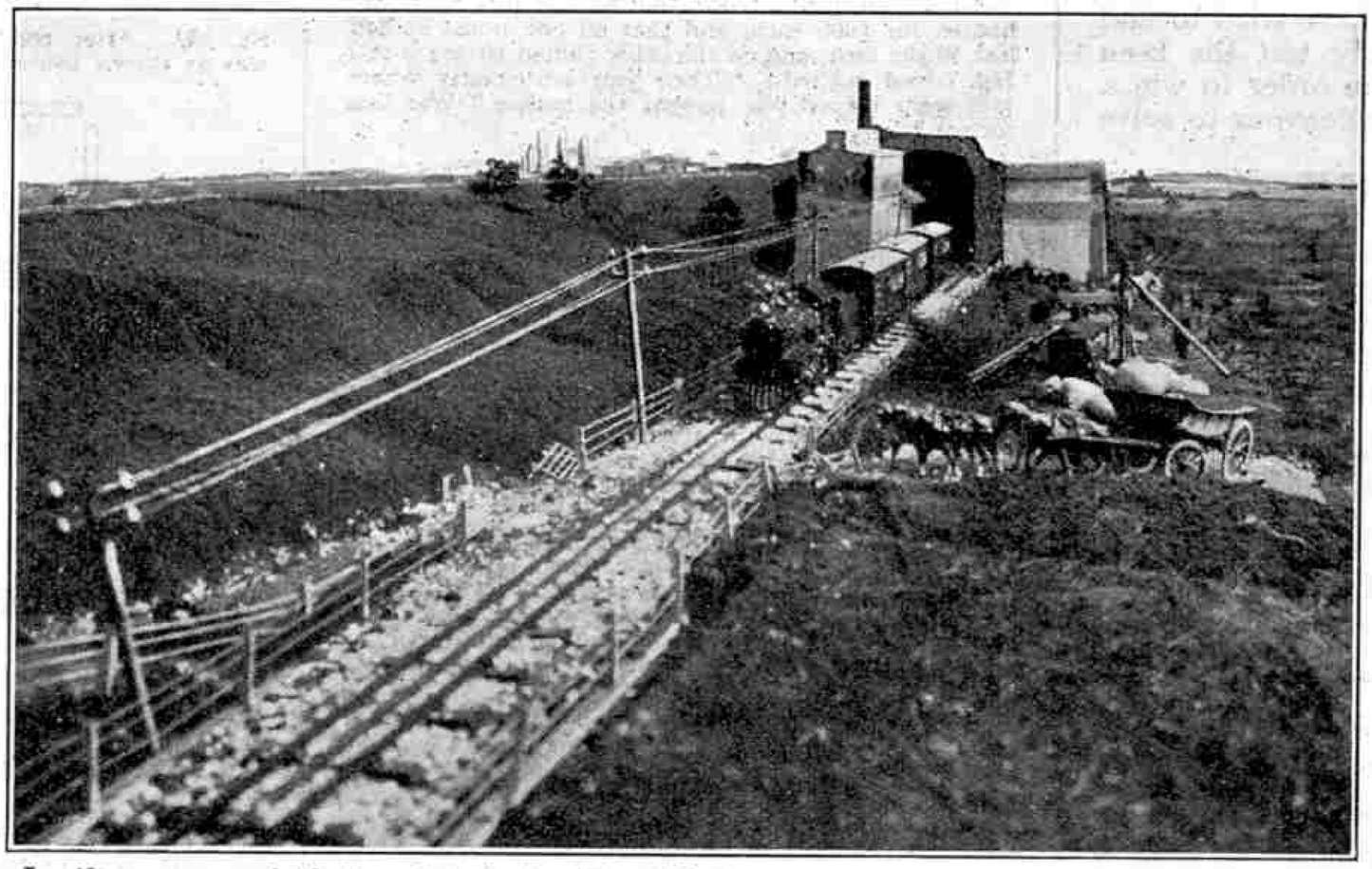
Puzzle No. 176.

A certain gentleman went out to buy Christmas presents for his family, and spent half the money he took with him. On arriving home he found that he had as many shillings as he had pounds when he went out, and half as many pounds as he had shillings to commence with. How much did his gifts cost him?



DOOR MATS MAKE MODEL RAILWAY SCENERY

AT the "FORCE" exhibit at a recent Exhibition, many thousands of boys and girls—many of them Meccano boys, paused in wonderment before a working model of a portion of the Canadian Pacific Railway track where it passes the "FORCE" mills at Ayr, Ontario. The effect was so surprisingly realistic that an account of how it was obtained will, I am sure, be of interest to all keen Meccano boys. Those who have model railways of their own will, undoubtedly, want to make a model on similar lines—let me warn them to be very careful not to be caught stealing mother's front door mat—for it is a door mat that contributes more than anything else to the success of the illusion.



In the course of 10 days this train (No. "0" gauge), travelled over a hundred miles on the track seen in this picture

The rail track was of number "O" gauge. The rails were steel fixed down to wooden sleepers complete with chairs and keys. The train was electrically driven with a copper rail to carry the current. Unlike the usual kind of scale model setting for a railway of this class, the scenery through which this train ran was designed in perspective so that a distance of 3 ft. from the track represented half a mile, while the last 6 ins. accounted for quite two or three more miles of scenery.

As you will see from the accompanying picture, this method of working produced a highly realistic effect. The greatest problem was to represent the wheatfields which supply the wheat for the "FORCE" mills and through which the train travelled. This is where the door mats came in. They were trimmed to represent stubble after the cut wheat had been cleared. These mats were raised in perspective to blend with the distant view of the hills on the horizon, which was painted on a piece of cardboard placed behind the mats. The sky was a large piece of ordinary linoleum painted sky-blue and curved into a semi-circle. The various models dotted about on the landscape were either made up from cardboard or, where possible, they were purchased ready-made from the nearest toy shop.

There is not a great deal of expense in preparing this kind of model railway setting. Beyond the initial cost of the mats nearly all the work depends upon the skill and ingenuity of the model maker, the other necessary purchases being nothing more than a few paint brushes and pots of poster colour, cardboard and wood. Ploughed land can be represented most successfully by using plaster of paris, "ploughing" it while wet, and then painting it in correct colours when dry.

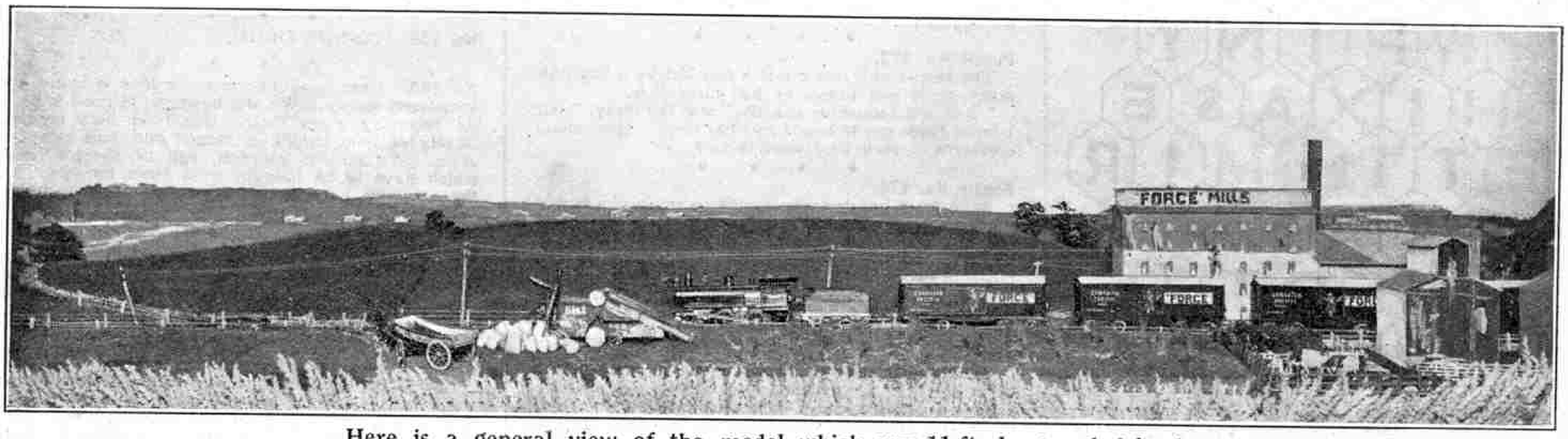
It is wonderful to think that it is from horizon wide belts of land like this comes the wheat from which is made the "FORCE" you have with hot milk at the breakfast table.

I suppose by now there is hardly a Meccano boy who has not tasted this delicious whole wheat cereal food. Daily thousands of young folk, as well as grown ups, enjoy this delightful product of the wheat fields. If by any chance you should happen to be one of the few who still have not succeeded in persuading their mothers to let them have "FORCE" regularly, go at once to mother and ask her, very nicely, to let you have "FORCE" to-morrow morning, not only because you will like it, but (let me whisper this) also because mother will have *no cooking at all* to do. "FORCE" is served with hot milk in a moment.

Yours forcefully,

Sunny Jim

P.S.—Look out for my page next month. I have a specially interesting message for you all.



Here is a general view of the model which was 11 ft. long and 4 ft. deep



Fireside Fun

GOT HIM THAT TIME!

Magistrate: "I seem to know your face."

Prisoner: "Yus; we was boys together."

Magistrate: "Nonsense. What d'you mean?"

Prisoner: "Yus, we was. We're both about the same age so we must have been boys together!"

* * * *

Big Brother: "Freddy, I'm surprised to see you soak your bread in the gravy on the dish. It's exceedingly bad form."

Freddy: "That may be, but it's awful good taste!"

* * * *

HELP!

First Girl: "I like Jim so much, he has 'wireless' eyes."

Second Girl: "Wireless eyes?"

First Girl: "Yes, he has a broad cast in them."

* * * *

Teacher: "A vacuum is lighter than any known gas."

Pupil: "Then why don't they use it to fill airships?"

* * * *

Finnigan: "Hello, Pat, have you seen Mike lately?"

Pat: "Well, I thought I saw him across the road the other day and he thought he saw me, but when we got up to one another it was neither of us!"

* * * *

A NASTY ONE!

A blacksmith and a carpenter spent a day at the local zoo, and the carpenter talked so much about the habits of the various animals that the blacksmith became very bored.

In due course they arrived at the monkey-house and the carpenter asked the blacksmith if he knew what the animals were.

"Well," replied the blacksmith, "judging by the sawdust on the floor they must be carpenters."

* * * *

Sergeant (drilling recruits): "About turn!"

All the recruits obeyed except Mike, and the Sergeant, purple with rage, walked up to him. "Didn't you hear 'About turn,' he roared?"

Mike: "No sergeant, what about him?"

THE DOCTOR NEVER THOUGHT OF THAT!

An old man applied at the local dispensary for spectacles and the doctor commenced to test his eyes. The old man was asked to read the letters on a test-card, but although he was brought nearer and nearer to the card he declared that he could not read the letters. Finally the doctor pushed him forward until his nose almost touched the card.

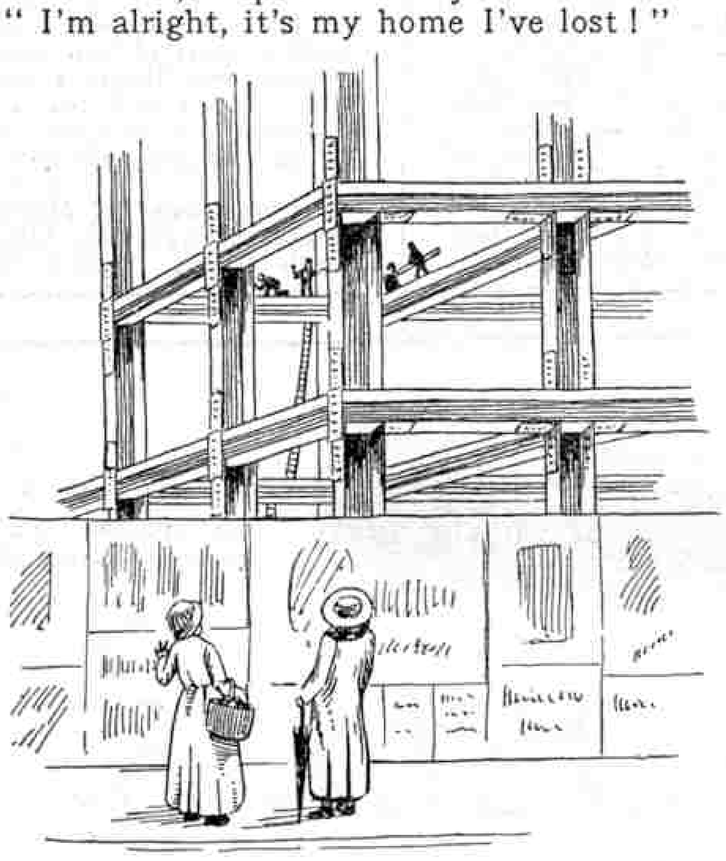
"Can you read it now?" he shouted.

"No sir," replied the old man. "You see, I never learnt to read."

* * * *

Kind Old Gentleman: "Why are you crying, my boy, have you lost yourself?"

"No sir," replied the boy between sobs. "I'm alright, it's my home I've lost!"



"Goodness Maggie, whatever's that they're a-building?"

"Dunno, Liza. It looks like a monument to Mr. Meccano!"

—"*Liverpool Post.*"

* * * *

NO EXCUSE!

Teacher: "Willie, you're late again, there's no excuse for it."

Willie: "No sir. I've been standing outside for 10 minutes trying to think of one."

* * * *

Teacher (to parent): "Do you know, your boy spells ridiculously?"

Parent: "Does he really? It's the first word I've ever known him spell."

* * * *

City Girl (staying at farm): "That bull always seems so savage when I go near him."

Farmer: "It must be on account of that red dress you are wearing."

City Girl: "Well, I know it's terribly out of fashion, but I didn't think a country bull would notice it!"

A SPEED MERCHANT!

Examiner in chemistry: "Suppose that glass vessel were full of poisonous gas. What steps would you take if the glass got broken?"

Student: "Long ones!"

* * * *

First Old Lady: "That sailor says they have to weigh the anchor every time they leave harbour."

Second Old Lady: "What nonsense. Why don't they make a note of how much it weighs, and have done with it?"

* * * *

Old Lady: "Conductor, can I take this car to Green Street?"

Conductor: "No, madam, I should get the sack if I lent it to anyone."

* * * *

A POSER!

Policeman (to burglar caught in the act): "Now I've got you."

Burglar: "Do you know my name?"

Policeman: "No."

Burglar: "Well, how d'you know it's me?"

* * * *

Unpopular Guest: "Longfellow's poems always carry me away completely."

Hostess: "I'm so sorry I haven't a copy."

* * * *

SOME MOTHER!

Tommy: "Jackie Smith's mother is a real good sort."

Jimmy: "How d'you make that out?"

Tommy: "She let Jackie have measles the day school opened."

* * * *

Nervous Passenger: "Captain, is this ship safe?"

Captain: "Well, she's a bit leaky, so she might go down. On the other hand, her boilers are a bit old so she might go up."

* * * *

Tompkins (in love): "Won't you sing for us, Miss Smith?"

Miss Smith: "Oh! I couldn't think of singing after such good music as we have heard."

Tompkins: "But I would rather listen to your singing than to all the good music in the world!"

* * * *

First Man: "I think you are unjust to Johnson, he is really not a bad fellow. He always throws himself into any work he undertakes."

Second Man: "Then I wish he would dig a well."

* * * *

Long: "Those are two fine melons you have there."

Short: "Yes, they are for my mother-in-law. She said she would give half her life for one, so I bought two!"

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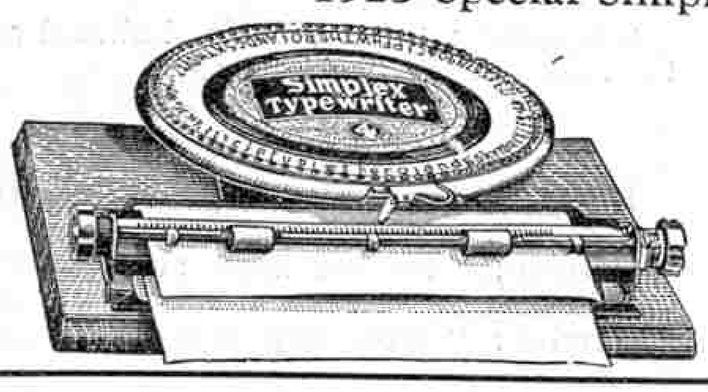
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1925 Special Simplex Typewriters

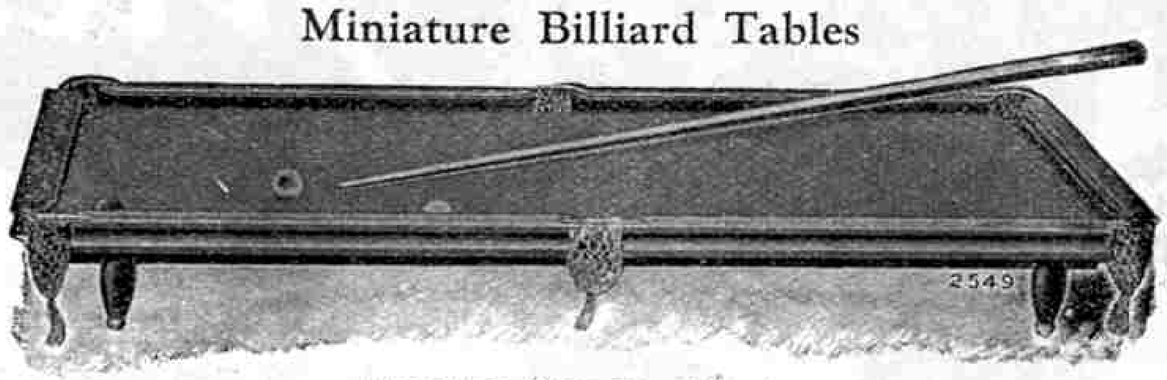


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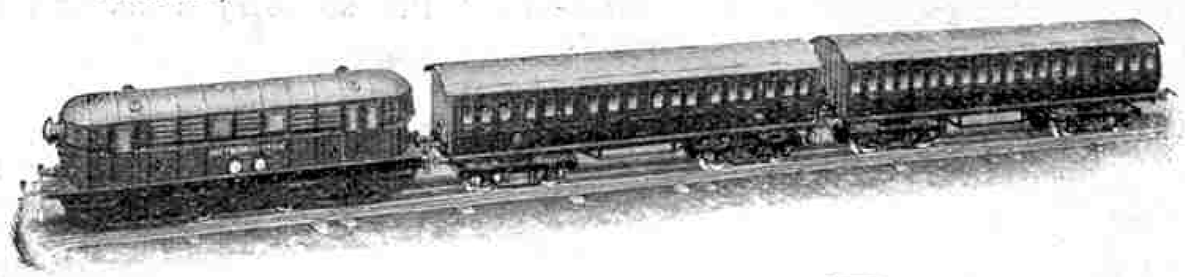


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All working parts are interchangeable. Made entirely of Fine Steel, including Trigger, Sear, Barrel, Plunger, Breech Plug and Muzzle Nug. Fitted with best Chrome Springs. The Pistol is shaped and designed on the very latest principle for easy handling and correct aiming. Price **10/6** each. Postage 9d.

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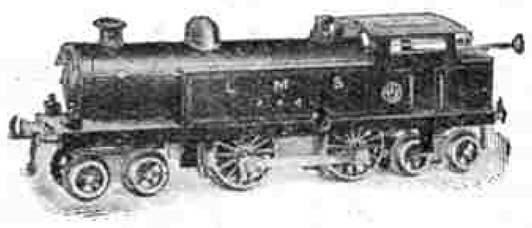


This is the Hornby Electric Train, a splendid model of the London Metropolitan trains. The powerful Loco 10 in. in length, is fitted with reversing switch and the whole train is lighted electrically.

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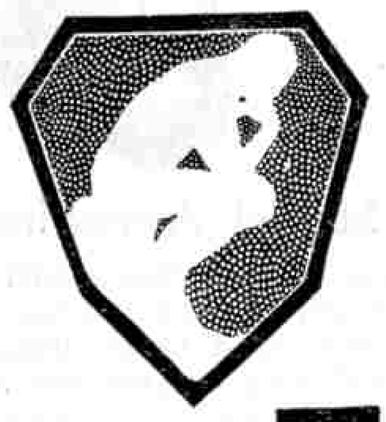
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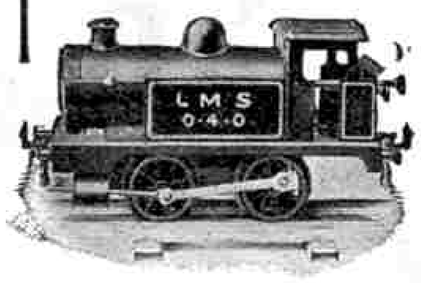
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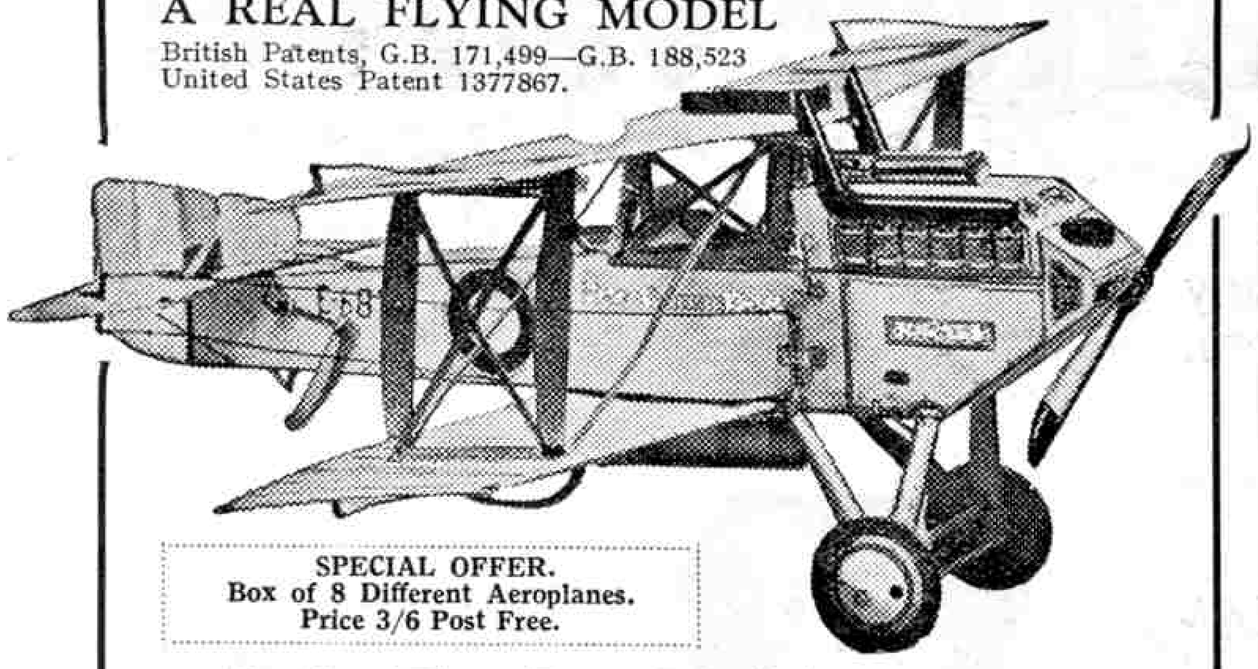


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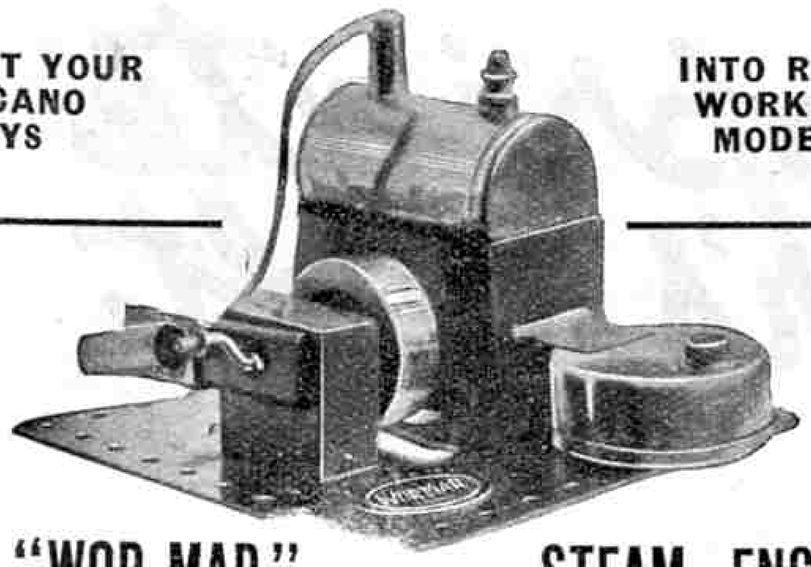
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Brief Specification: Brass oscillating cylinder, ⅜-in. bore, with accurately fitting piston. Heavy brass flywheel, 7/16 in. × 1½-in. Solid drawn brass boiler, 1½-in. × 2½-in., safety valve, new safety type lamp, giving great heat and absolute safety. Overall height, 4-in. Filler and instructions. Each engine tested and guaranteed to attain 3,000 to 5,000 revs. Will hum round, driving 6 models at once, such is the marvellous power obtained.

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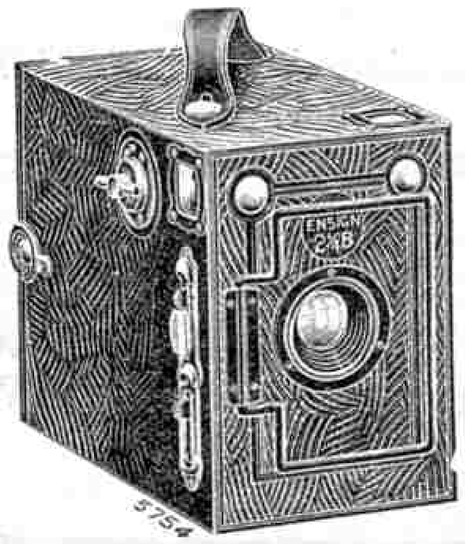
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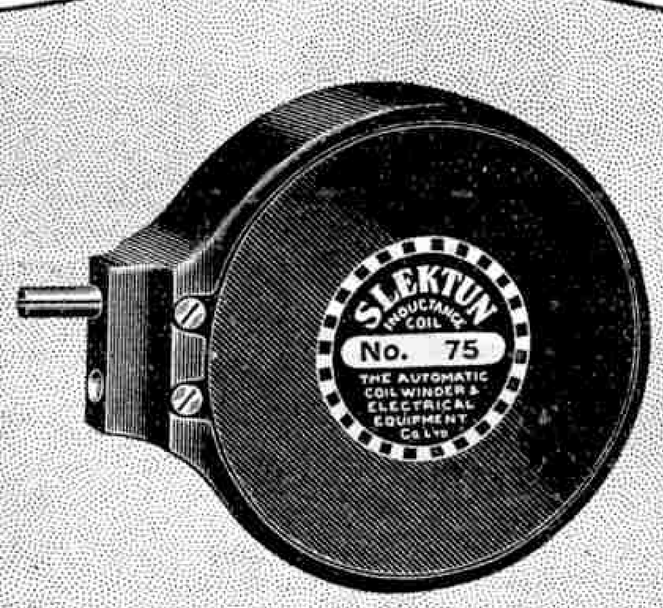
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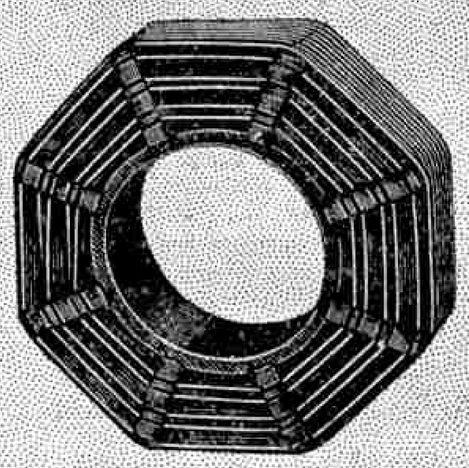
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COIL COMPLETE IN EBONITE CASE



METHOD OF WINDING & AIR SPACING

The Windings of the SLEKTUN INDUCTANCE COIL are spaced and separated in the most scientific manner, giving the **Lowest Distributed Capacity** with **High Inductance.**

COIL OF 200 TURNS — **INDUCTANCE: 1770 MICRO-HENRIES** — **SELF-CAPACITY: 3 MICRO-MICROFARADS**

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ALL CASES ARE ONE SIZE 3¼" IN DIAMETER AND 1⅛" IN DEPTH.

SLEKTUN COILS ARE THE MOST SELECTIVE AND EFFICIENT ON THE MARKET

No. of Coil.	Wave length range when in circuit with standard P.O. aerial.				Wave length range when used in anode or Secondary circuits.		
	.001 MF. in series.		.001 MF. in parallel.		.001 MF. in parallel.		Price per COIL.
	Min.*	Max.	Min.	Max.*	Min.	Max.*	
25	85	170	190	390	105	350	5/6d.
35	130	260	283	580	156	510	5/6d.
50	190	380	422	850	232	750	6/-
60	220	440	483	1000	265	870	6/-
75	240	480	535	1100	295	1000	6/-
100	290	580	649	1300	360	1200	7/-
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200	600	1200	1323	2800	733	2500	8/6d.
250	675	1350	1486	3200	836	3000	9/-

EVERY SLEKTUN COIL IS TESTED AND GUARANTEED AND IS MADE IN ENGLAND.

* In view of the fact that some loss in efficiency is occasioned when using very small capacity in series, and very large capacity in parallel with the Coils, it is recommended that purchasers should order such sizes which will tune well inside the above mentioned figures.

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THE AUTOMATIC COIL WINDER & ELECTRICAL EQUIPMENT CO., LTD., Dept. L.
"WELLINGTON HOUSE," BUCKINGHAM GATE - - LONDON, S.W. 1.

ROLLING STOCK AND ACCESSORIES

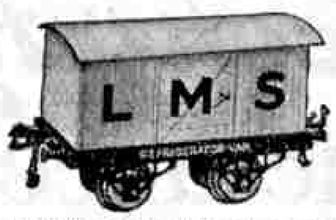
(HORNBY SERIES)

There are now 50 different train accessories—Stations, Signal-boxes, Lamps, Wagons, Level-Crossings, Foot-Bridges, Turntables, etc. Further accessories will be added to the system from time to time, and will be announced in the pages of the "*M.M.*"

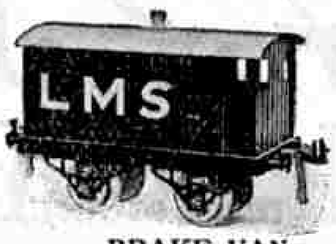
All Hornby Rolling Stock and Accessories are built in correct proportion to the size, gauge, method of coupling, etc., of the Hornby Trains and all have the uniformly beautiful finish that is the great feature of the Hornby series. With these accessories you can build up a most realistic railway system, and the splendid range of rails, points, and crossings make possible endless variety in rail layout. Hornby Trains are British made, and your dealer will be able to show you specimens of the new products.



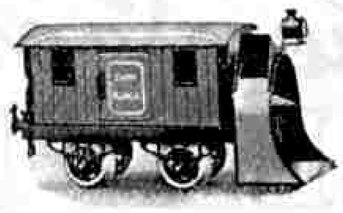
BRAKE VAN
Finished in grey, with opening doors. Price **4/–**



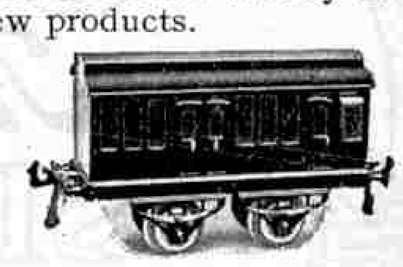
***REFRIGERATOR VAN**
Enamelled in white, with opening doors. Price **4/–**



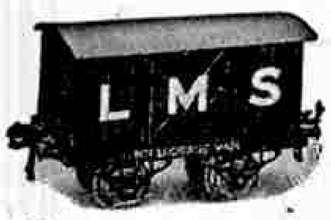
BRAKE VAN
Finished in grey, with opening doors. Price **4/–**



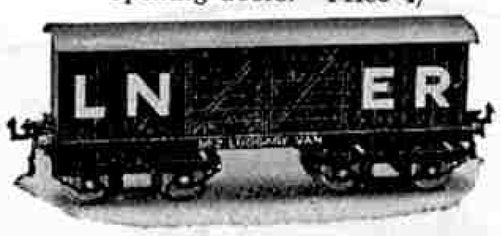
***SNOW PLOUGH**
With revolving plough driven from front axle. Price **5/6**



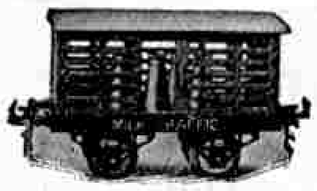
***GUARD'S VAN**
Realistic design, fitted each side with opening doors. Price **3/6**



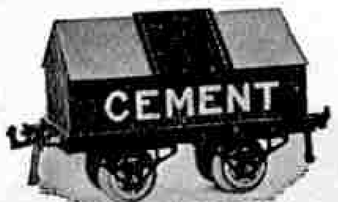
***No. 1 LUGGAGE VAN**
With opening doors. Price **4/–**



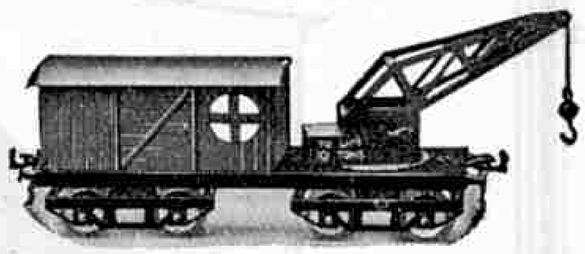
***No. 2 LUGGAGE VAN**
Finished in blue and green. Fitted with double doors. Suitable for 2-ft. radius rails only ... Price **6/6**



***MILK TRAFFIC VAN**
Fitted with sliding door, complete with milk cans. Price **4/6**



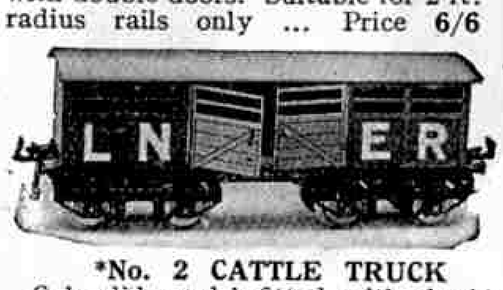
***CEMENT WAGON**
Finished in grey and black. Price **4/–**



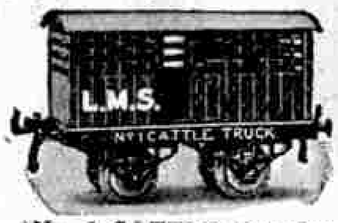
***BREAKDOWN VAN AND CRANE**
Beautifully coloured in grey and black, with opening doors. Suitable for 2-ft. radius rails only ... ... Price **7/–**



SECCOTINE WAGON
Beautifully finished in blue, with opening doors. Price **4/–**



***No. 2 CATTLE TRUCK**
Splendid model fitted with double doors. Suitable for 2-ft. radius rails only ... ... Price **6/6**



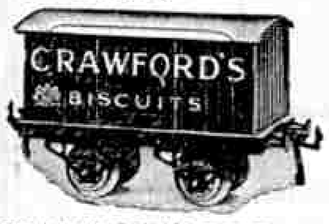
***No. 1 CATTLE TRUCK**
Fitted with sliding door. Very realistic design. Price **4/–**



SIDE TIPPING WAGON
Excellent design and finish. Price **3/6**



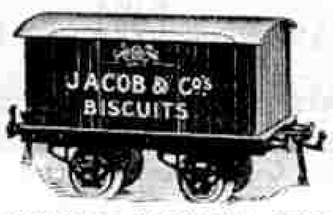
ROTARY TIPPING WAGON
Finished in grey and green. Price **4/–**



CRAWFORD'S BISCUIT VAN
Finished in red, with opening doors ... Price **4/–**



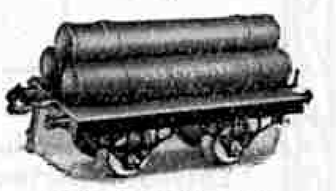
CARR'S BISCUIT VAN
Finished in dark blue, with opening doors. Price **4/–**



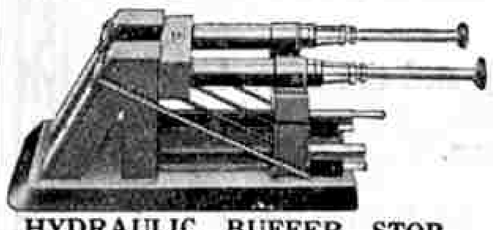
JACOB'S BISCUIT VAN
Finished in crimson lake, with opening doors. Price **4/–**



***GUNPOWDER VAN**
Finished in red, with opening doors. Price **4/–**



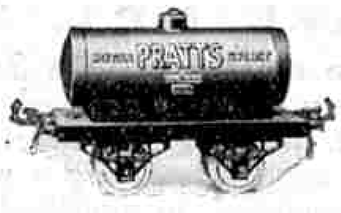
***GAS CYLINDER WAGON**
Finished in red, lettered gold. Price **3/–**



HYDRAULIC BUFFER STOP
Price **5/–**



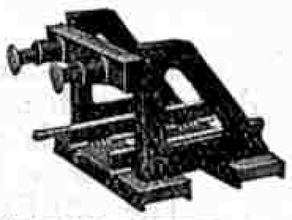
PETROL TANK WAGON "SHELL"
Finished in red. Price **3/–**



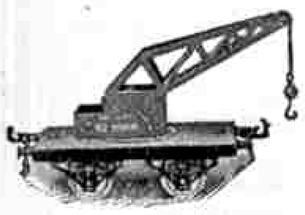
PETROL TANK WAGON "PRATTS"
Finished in green. Price **3/–**



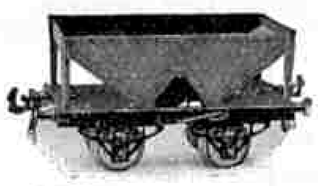
MOTOR SPIRIT TANK WAGON "NATIONAL BENZOLE"
Price **3/–**



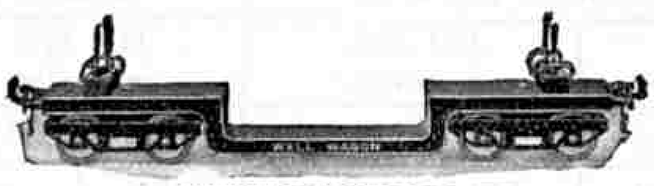
SPRING BUFFER STOP
Price **1/6**



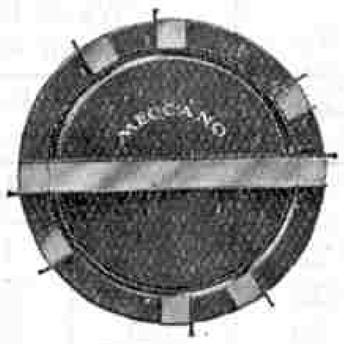
***CRANE TRUCK**
Finished in grey and black ... Price **4/6**



***HOPPER WAGON**
Mechanically unloaded. Finished in grey and black ... Price **4/–**



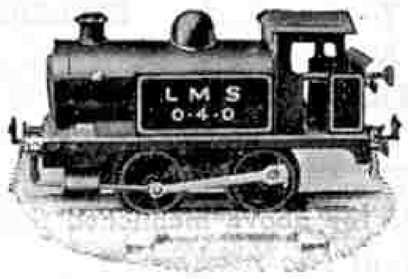
***TROLLEY WAGON**
Finished in grey and red. Suitable for 2-ft. radius rails only ... Price **6/–**



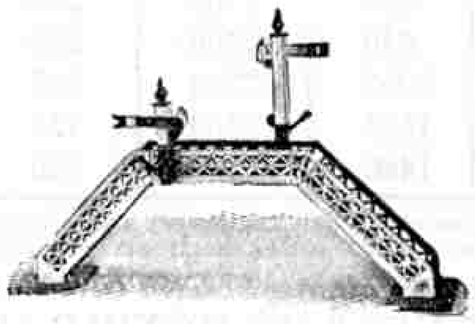
TURNTABLE
Price **5/–**



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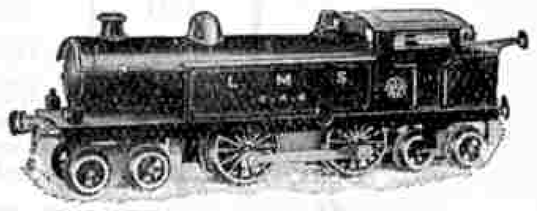


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No.1. With detachable Signals Price **6/–**
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Signals only ... ... per pair **2/9**

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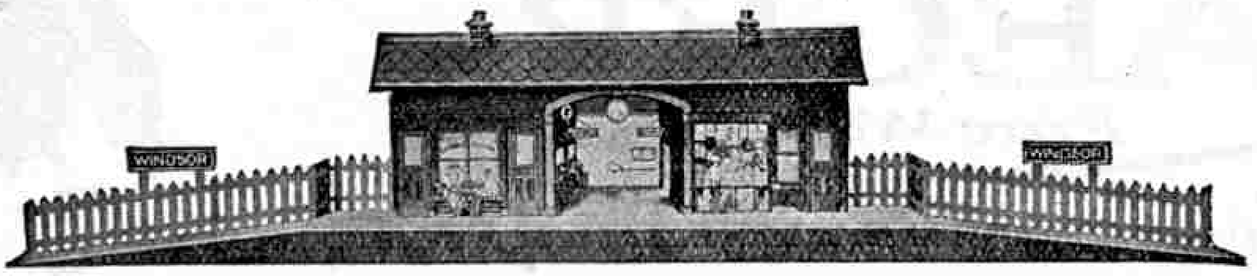
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Beautifully finished in colours to represent L.M.S. or L.N.E.R. Companies' locos. Fitted with reversing gear, brake and governor. ... ... Price **30/–**

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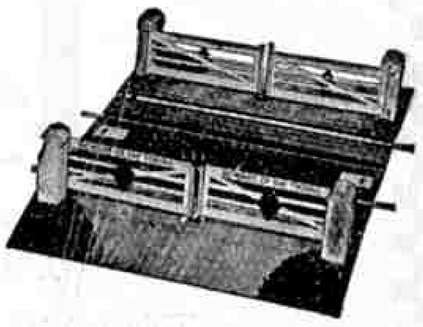
(HORNBY SERIES—*continued*)



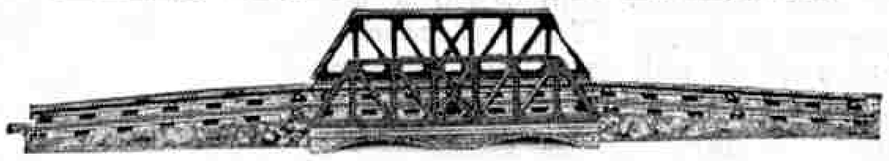
SIGNAL CABIN
Dimensions: Height 6½ in., Width 3½-in., Length 6½-in. Finished in colour and lettered "Windsor." Roof and back open to allow signal-levers to be fitted inside cabin if desired.
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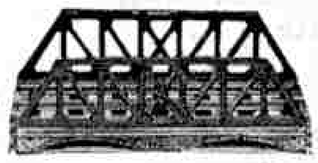
RAILWAY STATION. Excellent model, beautifully designed and finished. Dimensions: Length 2-ft. 9-in., breadth 6-in., height 7-in. Price **12/6**



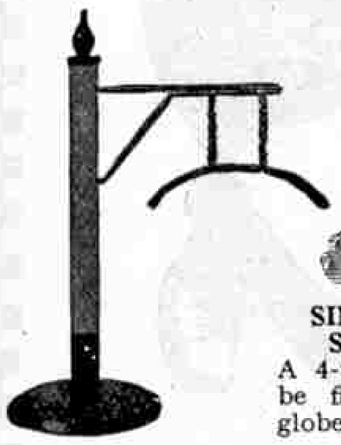
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Beautifully designed in colour. Measures 11½ × 7½-in. with Gauge 0 rails in position.
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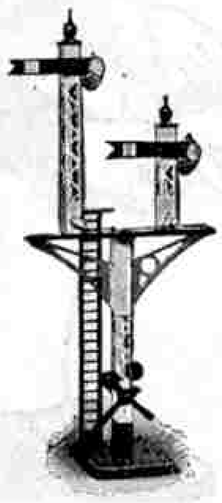
VIADUCT (Centre Section only) Price **4/6**
ELECTRICAL VIADUCT (Centre Section only) Price **5/-**



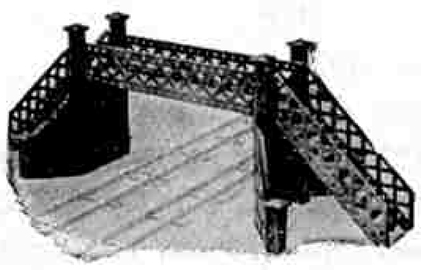
LOADING GAUGE
Price **1/9**



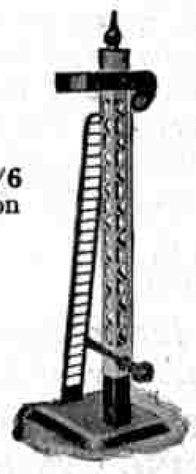
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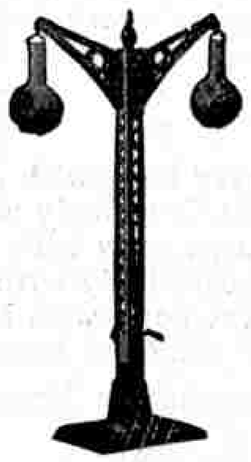
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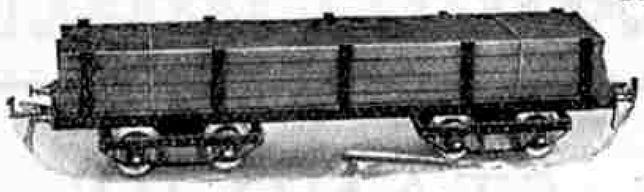


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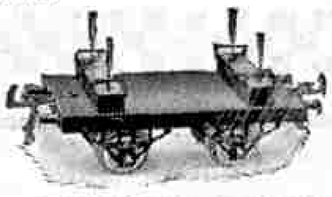
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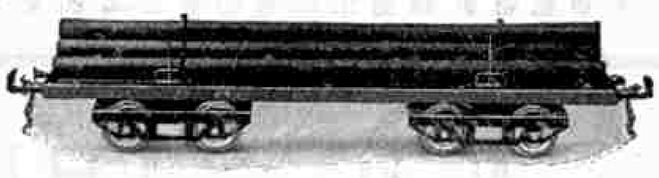
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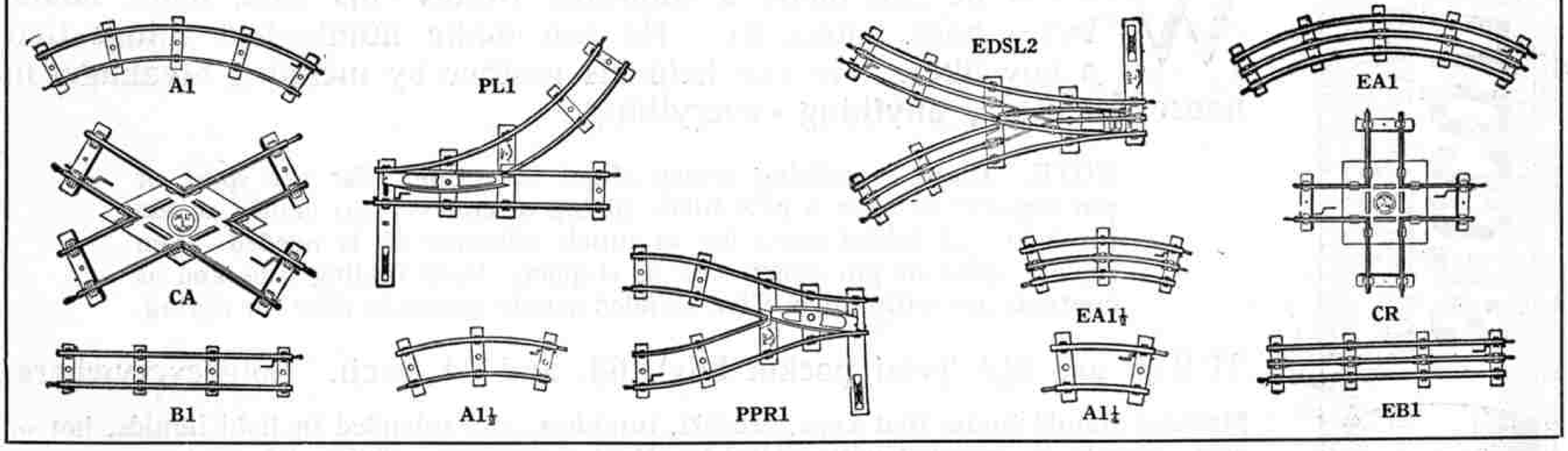
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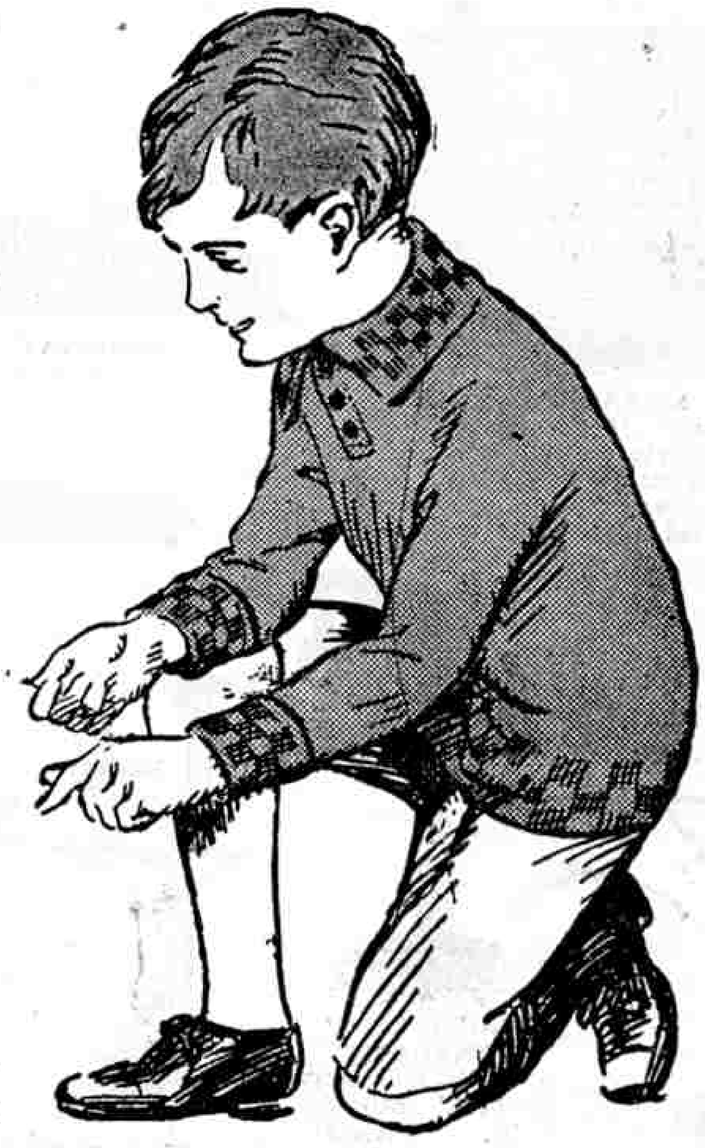
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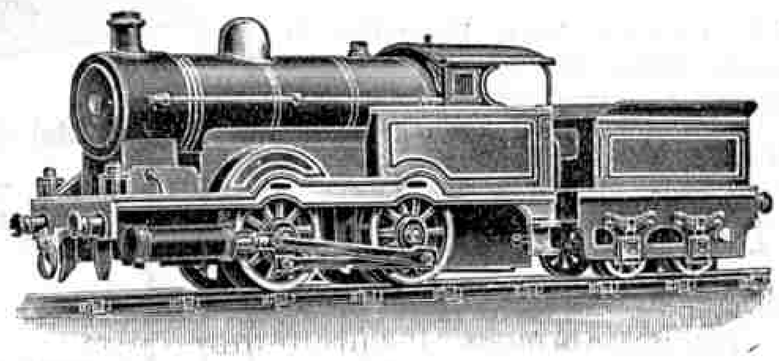
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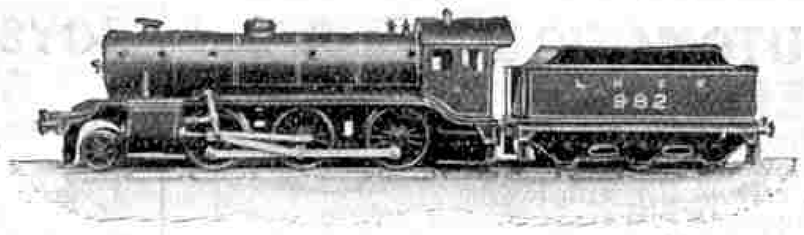
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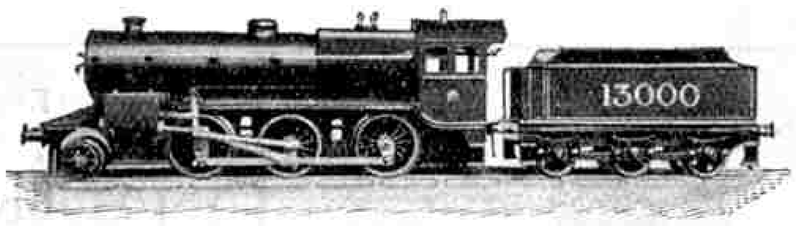
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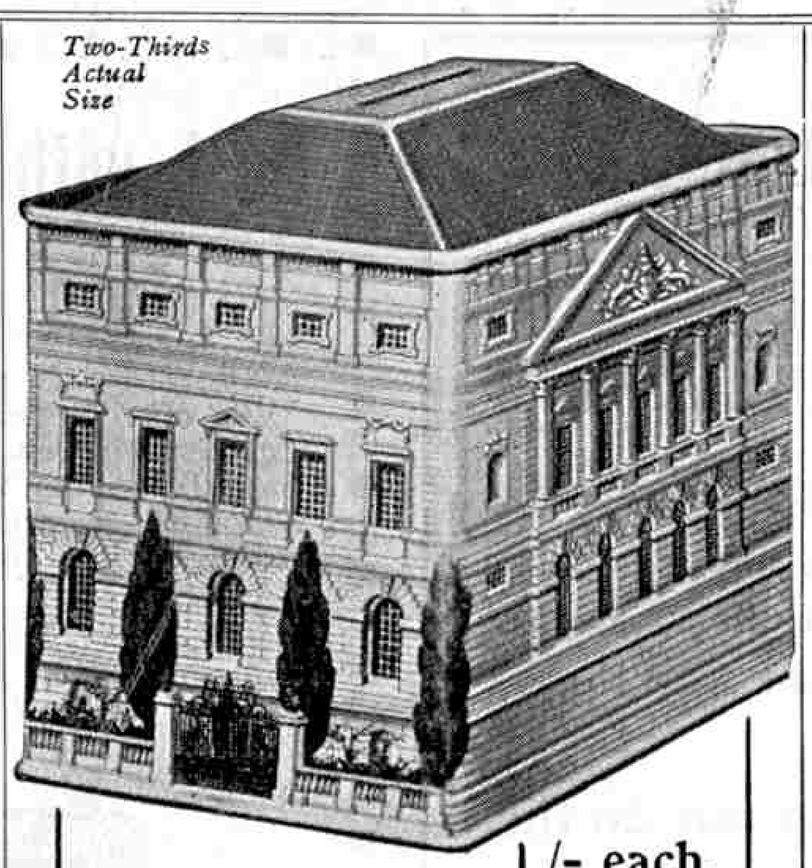
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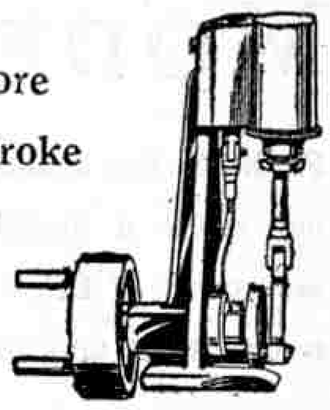
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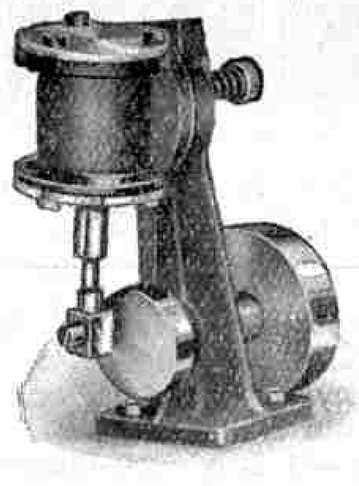
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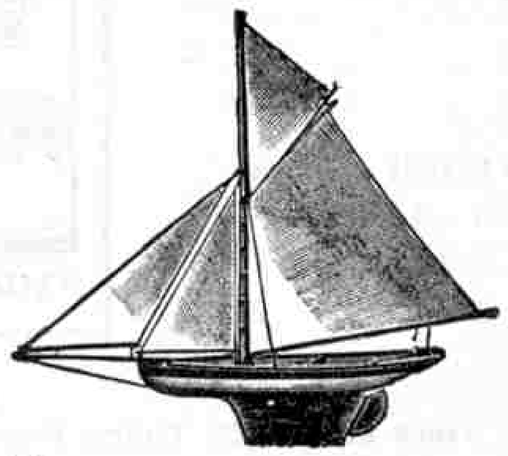
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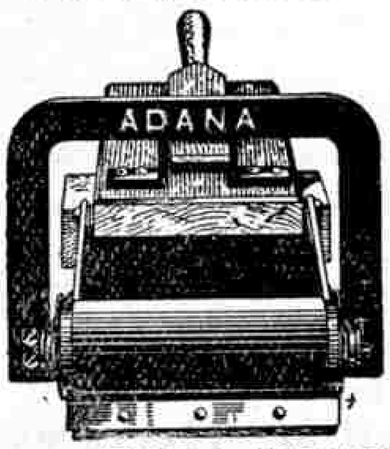
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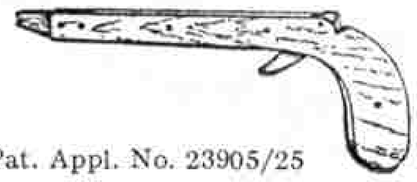
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is the very thing if you want some good sport these holidays.

You can learn to shoot quite accurately but quite harmlessly.

You can shoot the loop at a match box across the room and hit it. You can shoot at a mark on the window but not break the glass.

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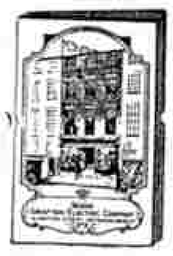
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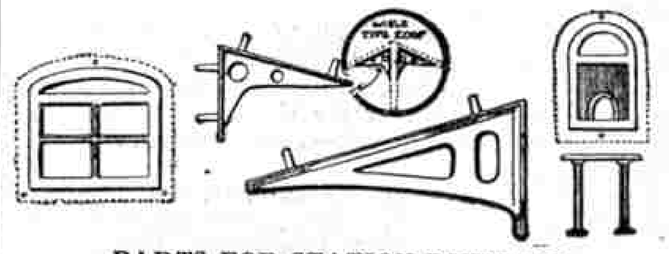
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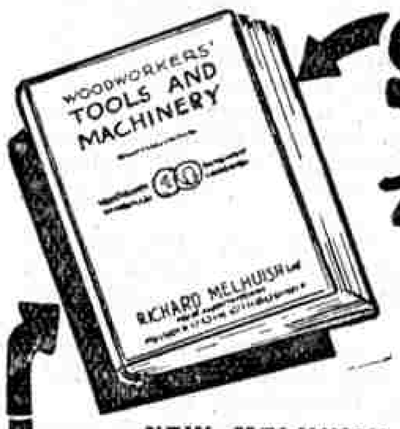
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Readers' Sales and Wants



If you have anything to sell or wish to buy anything take advantage of the service offered by a small advertisement in these columns.

The "*M.M.*" is read by approximately 100,000 people every month. It circulates in every country where the English language is spoken. If you wish to sell your duplicate stamps, your rabbits, or your tools, or to purchase a loud speaker, a steam engine, a model yacht, or a hundred-and-one other things, you will be able to do so through the columns of the "*M.M.*"

The rates are one penny per word, with a minimum of 1/- (cash with order).

Your advertisement must be received before the 10th of the month for insertion in the following month's issue.

If a Box Number is used, 4d. should be added to cover the cost of postage of the letters to the advertiser from this office. The letters will be posted one week after the advertisement appears, and a second batch a month after the advertisement appears. They will be sent more frequently if additional postage is included with the advertisement.

IMPORTANT.—Advertisements dealing with any articles in the Meccano catalogue cannot be accepted.

READERS' SALES

(*Rate: 1d. per word, min. 1/-*).

For Sale. Miniature Table Railway. Perfect order, extra points, guard's van, 8/6 post free.—Clark, 3, St. Vincent Road, Doncaster.

10 volt, 5 amp. Dynamo, £1; 4 volt Motor, 7/-; No. 1 Brownie Camera, 10/-.—James Robertson, Clachaig, Killin, Perthshire.

Miscellaneous Collection of boys' goods for sale, half price. Free Gifts. For price list apply—Courts, 2, Elvan Terrace, Ibrok, Glasgow.

2,000 Cigarette Cards, Miscellaneous, 6d. per 100, postage 1½d. stamp.—Radcliffe, Morland Hall, Alton, Hants.

Complete Miniature Table Railway, 14 extra parts, 17/-. Cost 25/-.—Curtis, Ballynew, Castlebar, Mayo, Ireland.

Magnet Library, Nos. 897-923. What offers? 3/- or up.—Hubbard, 46, Brisbane Road, Reading.

Sale. Cinematograph in good condition, acetylene lighting, cost £1, together with 2 long films and 23 slides. Offers—Hutchinson, Ault, Hucknall, nr. Chesterfield.

Clean Cigarette Cards for sale, 1/- for 100.—Brinley Morris, "Arfon," Belle Vue, Treforest, Glam.

750 Cigarette Cards, 9d. per 50; Sets, 50 1/-; 25 6d. Volume "Scout," 7/-.—Rackstraw, 60, Abercrombie Avenue, High Wycombe, Bucks.

Cinema and Lantern Combined. Oak base, lamp, spools, silent and steady movement, 3,000 ft. of film, slides, new Xmas. Cost £9. Take £5 or offers.—Cornish, 16, Mina Road, Merton Park, London.

For Sale. Compactophone, two reproducers, five double-sided records, £2.—Knight, 68, High Street, Brighton.

800 Cigarette Cards, 9d. per 100.—Salisbury, Winslade, Reigate Road, Reigate, Surrey.

Fairy Cycle, used twice, cost 57/6. Take 40/-.—E. Crow, 150, Knockhall Road, Greenhithe, Kent.

Stamps. Collection of Foreign Stamps, catalogued over £4. What offers?—R. Welsh, 1, Frank Place, Hawick, Scotland.

Cigarette Cards, sets of 50, 1/-; 25, 6d.—R. Grantham-Hill, 49, High Road, Chiswick, W.4.

Youth's Cycle, 45/-. Five volumes B.O.P., 3/- each. 1,500 clean Cigarette Cards, 2 Albums, 8/-. 100 Pre-war Stamps, 6d.—Peach, Winkfield Row, Bracknell, Berks.

Point, acute crossing, 10 straight, 6 curved rails, Gauge 0, all electric, 1' 9" diam., good condition, 10/-.—Holland, Linton Lodge, Gravesend, Kent.

"Miss America" Steam Launch, will accept 7/6.—Jerram, 63, Boundary Road, East Ham. (No exchanges).

Cigarette Cards, 7 complete sets in album, also 1,500 mixed. What offers?—Gant, 37, Inchmery Road, Catford, London.

Cigarette Cards. Sets of 50, 1/-, and 25, 6d. Enclose stamp for list. First come, first served.—Stanley Wall, School House, Great Witley, Worcester.

Cinematograph, cost 30/-, almost new, 15/-. Collection about 1,000 stamps and new album, 10/-. Hobby-Horse Scooter with adjustable saddle, 7/6.—Alan Purves, 86, High Street, Berwick-on-Tweed.

Sale—1924 Volume Scouts, unbound, 6/-; also 26 others, 3/-.—L. Townley, 4, St. George St., Swansea.

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Stamps. Free gift of unused set. Request approvals only. Am selling collection. Extra gift if postage is included.—T. Vallance, 254, Portland Road, Edgbaston, Birmingham.

Cinematograph (Magic Lantern combined). Films, Screen, etc., 19/-. Babcock Boiler 25/-, cost 30/-, nearly new.—42, High St., Herne Bay, Kent.

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Patents, Trade Marks, Inventions, Advice Handbook and Consultations free.—B. T. King, Regd. Patent Agent, 146a, Qn. Victoria St., London, E.C.4.

CINEMA FILMS, 100 ft. 1/-, 1,000 ft. 6/-, delivered.—Phillips, 64, Ewart Street, Brighton.

Cinematograph Films and Cheap British-Made Machines. Lists free.—Filmeries, 57, Lancaster Rd., Leytonstone, London.

How to Make a Home Cinematograph Machine. Write for free particulars.—Royal Cinemas (Desk 10), 4, Brathway Road, Wandsworth, London.

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Cinema Films, Machines, Accessories; cheap hire and exchange, 100 ft.film and lists,1/ .—J. Humphreys, 40, Davenant Road, London, N.19.

HOME CINEMATOGRAPH MACHINES from 3/6 to £20. Film Bargains from 1/-. Send for illustrated catalogue post free.—Cinema Service, Dept. R., 19-20, Craven Street, Charing Cross, London.

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With large drawer and bottom shelf, specially suitable for Meccano and Wireless work, nicely finished in brown wax polish, fully mounted. 20/- Carriage forward.

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LEVER SELF-FILLING
FOUNTAIN PEN
Marvellous Value, Fitted with 14 Carat Gold Nib 5/-
Wood & Son, 62, High St., Perth

CUT THIS OUT. 'Meccano' Pen Coupon, Value 3d.
Send 5 of these coupons with only 2/9 direct to the **Fleet Pen Co., Fleet Street, E.C.4.** You will receive by return a splendid British 14-ct. Gold Nibbed Fleet Fountain Pen value 10/6 (Fine, Medium, or Broad Nib). If only 1 coupon is sent the price is 3/9. 3d. less for each extra coupon up to 4 (Pocket Clip 4d.) Satisfaction guaranteed. Your own name gilt letters, either pen 1/- extra. **Lever Self-Filling Model with Safety Cap, 2/- extra.**



MECCANO MAGAZINE

Registered at G.P.O., London, for transmission by Canadian Magazine Post.

EDITORIAL AND ADVERTISING OFFICES:—
BINNS ROAD, LIVERPOOL.
Telegrams: "Meccano, Liverpool."

Publication Date. The "*M.M.*" is published on the 1st of each month and may be ordered from any Meccano dealer, or from any bookstall or newsagent, price 3d. per copy. It will be mailed direct from this office, 2/- for six issues and 4/- for twelve issues.

To Contributors. The Editor will consider articles and photographs of general interest; payment will be made for those published. Whilst every care will be taken of those submitted, the Editor does not accept responsibility for any loss or damage. A stamped addressed envelope should be sent where the contribution is to be returned if unacceptable.

Binding Cases. Spring-back Binders to take a number of "*M.M.'s*" are supplied, covered with imitation leather and lettered in gold, price 3/- each (post free).

Meccano Writing Pads. Fifty sheets of tinted bank paper, each printed with Meccano boy at head, 1/- (post free) large size, and 6d. (post free) smaller size.

Advertisements

Readers' Sales and Wants. Private advertisements (*i.e.* not trade) are charged 1d. per word, minimum 1/-. Cash with order. Editorial and Advertising matters should not be dealt with on the same sheet of paper.

Small Advertisements. 1/- per line (average seven words to the line), or 10/- per inch (average 12 lines to the inch). Cash with order.

Display. Quotations for space bookings, and latest circulation figures, will be sent on request.

Press Day, etc. Copy must be received not later than 10th of each month for publication in following issue. Half-tone blocks up to 100 screen.

Proofs of advertisements will be sent when possible for space bookings of not less than half-an-inch.

Voucher Copies. Sent free to advertisers booking one inch or over. Other advertisers desiring vouchers should add 4d. to their remittance and should order voucher copy at same time.

Remittances. Postal Orders and Cheques should be made payable to Meccano Ltd.

Obtaining the "*M.M.*" Overseas

Readers Overseas and in foreign countries may order the *Meccano Magazine* from regular Meccano dealers, or direct from this office. The "*M.M.*" is sold Overseas at 3d. per copy, or mailed (post free) direct from Liverpool, 2/- for six issues, or 4/- for twelve issues.

IMPORTANT.

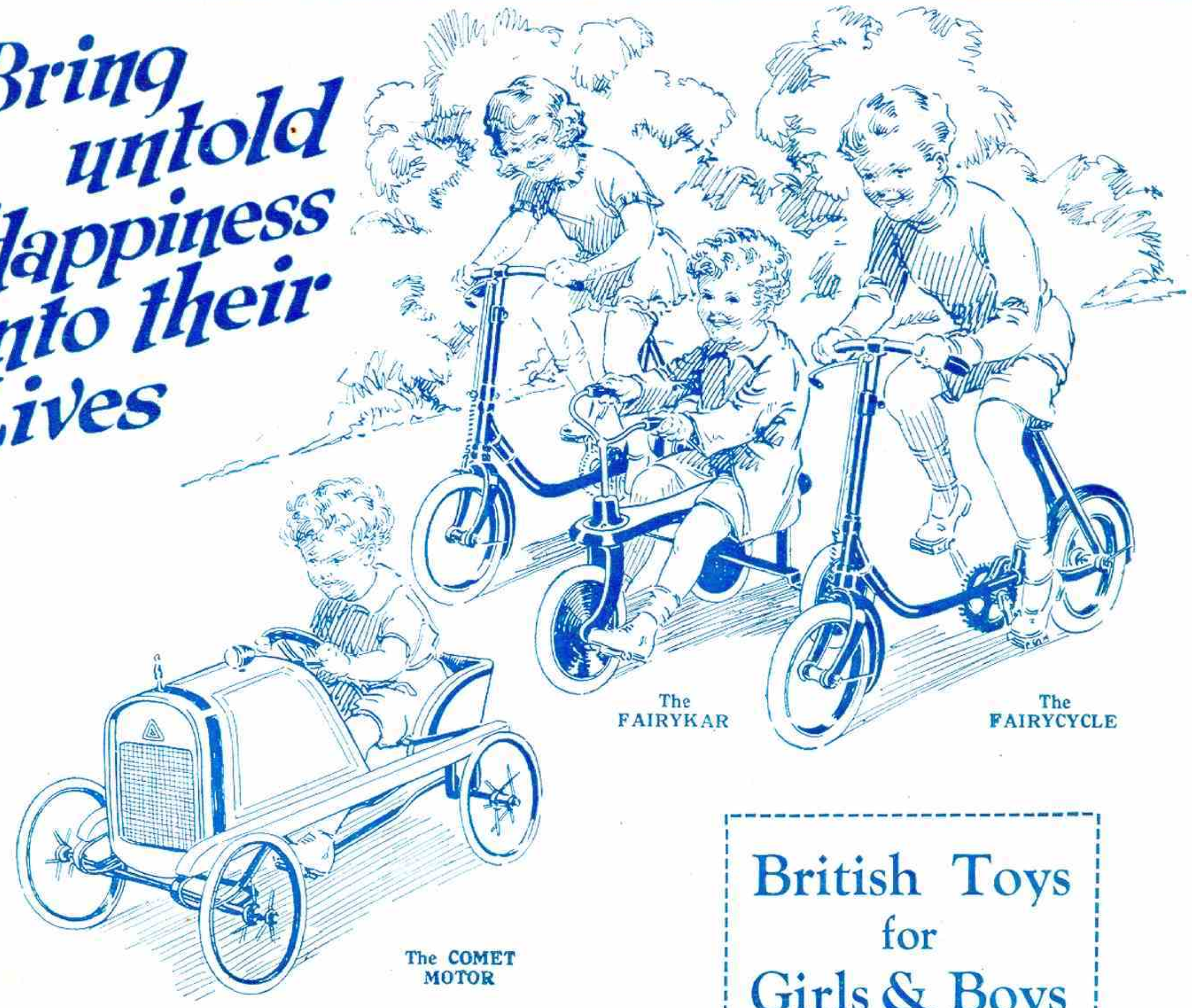
Overseas readers are reminded that the prices shown throughout the "*M.M.*" are those relating to the home market. Current Overseas Price Lists of Meccano Products will be mailed free on request to any of the undermentioned agencies. Prices of other goods advertised may be obtained direct from the firms.

CANADA:	Meccano Ltd., 45, Colborne Street, Toronto.
AUSTRALIA:	Messrs. E. G. Page & Co., 52, Clarence Street, Sydney, N.S.W.
NEW ZEALAND:	Messrs. Browning, Ifwersen Ltd., P.O. Box 129, Auckland.
SOUTH AFRICA:	Mr. A. E. Harris (P.O. Box 1199), Textile House, Von Brandis St., Johannesburg.

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Bring untold Happiness into their Lives



The FAIRYKAR

The FAIRYCYCLE

The COMET MOTOR

The COMET

Regd. Trade Mark.

This natty little racing model is the very thing for the youngsters. It is built for sturdy boys and girls, and will stand any amount of rough wear. The double crank movement makes it very speedy. For ages 2½ 5 yrs.

Only 27/- each

with wired-on rubber tyres. Many other models up to enclosed Saloons with ball-bearing pedals and balloon size tyres.

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Baby will love this Pedal Fairykar. There is nothing to beat it. It is beautifully painted a bright red with nickel-plated handle bar and stem, rubber pedals, etc. A splendid health-giving toy.

Size 4, 15/- Size 5, 22/6

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If only you had a Fairycycle just think what fun you could have, and what splendid exercise you would get in riding it. The Fairycycle is a real Cycle—not a make-believe. It is beautifully constructed, and runs with remarkable ease, and is SAFE because the low riding position makes it easy to control, and it is BRITISH.

BE SURE YOU RIDE A FAIRYCYCLE

49/6

Usual Standard Model also with ⅞" Ribbed Cushion Tyred Ball-bearing Tangent Spoke Wheels, De Luxe Model, 61/6

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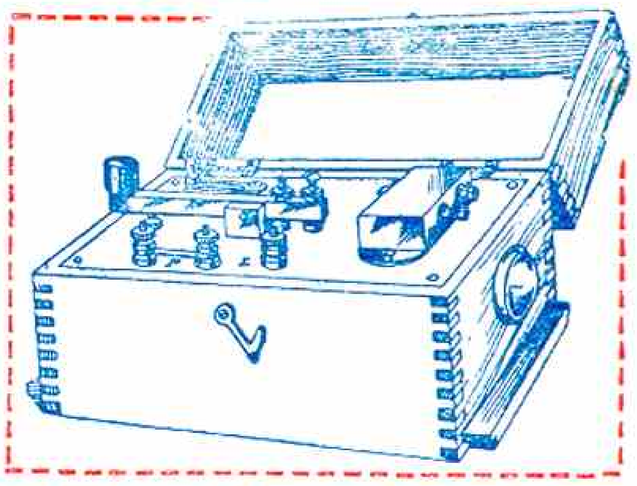
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It teaches you as it interests you if it is practised the Statham way. Refills for your boxes are easily obtained. Splendid Outfit illustrated with chemicals sufficient for 50 experiments and the instructions for doing them. Post 6d.

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Other Outfits 3/3, 14/6, 32/6, 52/-

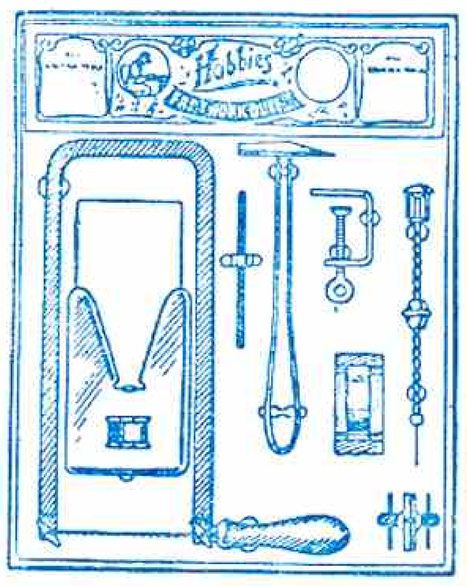
But the Meccano Boy is certain to make that resolution —He knows where it is that he can get all the things he needs for his various hobbies at prices which he can afford to pay. During 1926 Gamages will have even a greater collection of things to interest you. Don't forget to make an early call, or, failing this, write for one of our huge range of Catalogues (mention your hobby and Meccano Magazine).



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16/6



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3/6



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The "Scholar." Lacquered brass, with adjustable spring slide, suitable for examination of cheese mites, pond life, etc. Magnifies width 50 times, with 2 prepared micro objects, 2 plain glass plates, 2 glass plates with cavity. Post 3d. Price

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As above but with 3 only glass plates 2/-

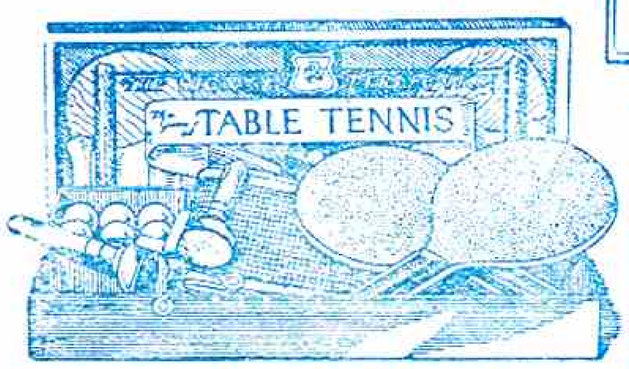
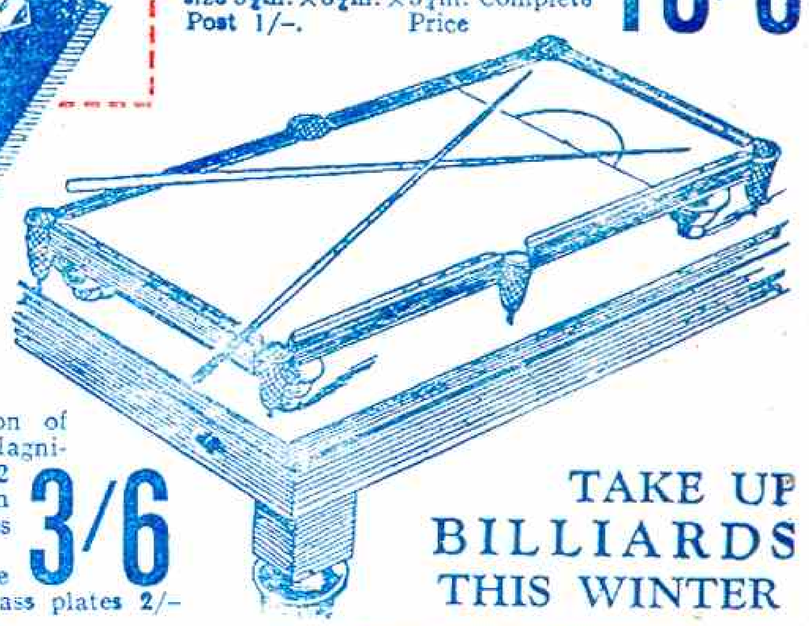


TABLE TENNIS THIS WINTER

Gamages offer a splendid range of sets—one to suit every taste and pocket. No. 3 contains superior metal posts and clamps with green cord net and white band, bats and balls complete. Post 6d.

3/11

Other sizes and qualities 1/10½, 2/11, 5/11, 6/11, 7/11 and upward.



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Here's what you want to learn on. Oak Miniature Billiard Tables to stand on large table. Compo board, Bed covered with green cloth, rubber cushions. Complete with cue and set of balls. Table size, 30 inches. Price

15/6

Other Sizes 3ft. 3ft. 6in. 4ft. 5ft.
Prices 24/6 29/6 45/- 78/6
Carr. extra.

Wireless!

You will find this sturdy and handsome set just the thing! The Brownie No. 2 Set is made from one solid moulding, thus forming a very substantial apparatus to handle. Complete with semi-Opal Glass Protected Detector, D.L.S. Crystal and "Pallmadium" Catswhisker.

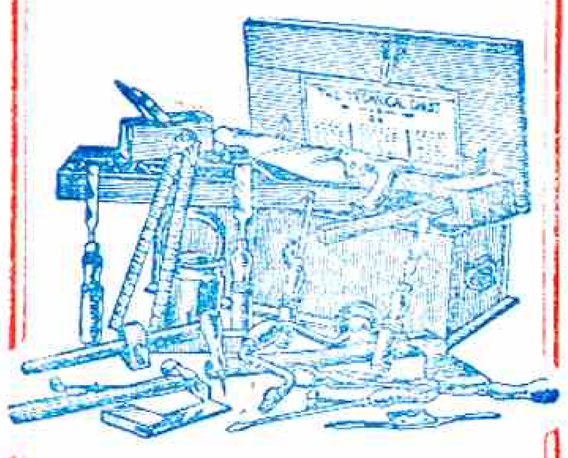
10/6

Post free. Price

If you are interested in Radio you should write for our Radio List. It has 38 pages full of everything that's best in wireless, at the most moderate prices.



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You cannot do better than use one of these cabinets if you wish to get the best results from your hobby. Strong Deal Chests, containing plane, hammer, punch, gouge, gimlet, screwdriver, chisel, bradawl, boxwood rule, gluepot, spokeshave, file, handsaw, tacklifter and pincers. Carriage 6d. Price

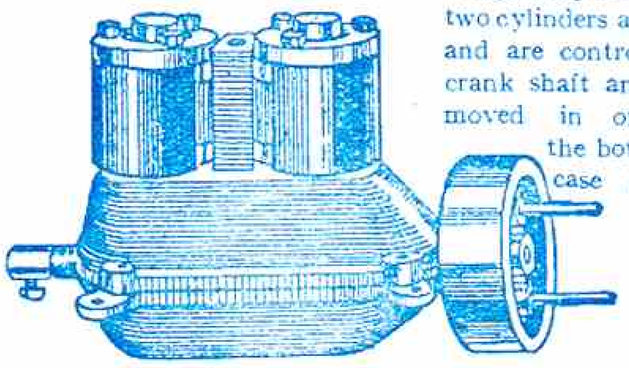
25/6

Other Outfits 3/6, Post 4d.; 4/3, Post 4d.; 5/-, Post 4d.; 15/9, Carr. 6d.; 40/-, Carr. free; 48/-, Carr. free.

MODEL LAUNCH ENGINE

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Are you interested in Model Engines? If you are, write for one of our model engineer catalogues, post free to Meccano Boys.

Get one of these PERISCOPES!

Just think how useful they can be, you can see over the heads of people if you are watching a procession or demonstration and those of you who are scouts can think of a host of uses for them. They only cost, Post free

2/6

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